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JOURNAL *of* EDUCATIONAL RESEARCH

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OUR HOMOGENEOUS-ABILITY GROUPING CONFUSION

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THE Ninth Yearbook of the Department of Superintendence lists the advantages and disadvantages of homogeneous grouping as stated by 500 superintendents of schools. These administrators reported twenty advantages and twenty-two disadvantages. The advantages were mentioned a total of 1326 times, and the disadvantages a total of 867 times. Considering these figures alone, it is obvious that the general attitude is favorable toward homogeneous grouping. The vote, however, to many minds will not be conclusive because there is still evidence of fundamental disagreement. If we examine specific statements of advantage or disadvantage this becomes clearer. For example, 173 superintendents state that slow learners in separate groups are more encouraged than when competing in classes with fast learners, whereas 150 superintendents state that the slower groups lose the stimulus and the contributions of the faster pupils. These statements are diametrically opposed to each other. Both cannot be true except as certain conditions not mentioned are influential. If this is so, the conditions must be understood before an explanation of the disagreement can be found.

Further instances of contradictory statements can be found as one studies the two lists. It is evident that we have not arrived in our thinking at the fundamental issue involved. This discussion is an attempt to analyze the issues which cause the confusion.

One of the chief issues is the failure to distinguish between two distinct types of grouping both indiscriminately known as "homogeneous" and "ability" grouping. One type, which we will call in this discussion "homogeneous grouping," attempts a finer classification than is afforded by grades. In any grade there is such a wide range of achievement that teachers find it difficult to adapt the work and hence the expedient of

forming groups is tried, sometimes accompanied by attempts to adapt methods and amount of subject matter to each of the groups. The aim of this kind of grouping is to secure greater achievement in traditional subjects. Another type of grouping, which will be called "ability grouping," is an attempt at a new kind of classification rather than refinement of the traditional classification. These groups may or may not be as homogeneous as the groups mentioned above. The purpose is not more efficient teaching of traditional subject matter, but the providing for different needs of different groups through differentiated curricula.

There is a certain advantage in homogeneous grouping, as above defined, inasmuch as the teacher distributes her time more equally among all pupils, and the faster working pupils do not have to endure the slowness of others. If this is the object of the grouping it is natural that the success should be measured in terms of achievement in the particular subjects which are being taught. Frequently there is no adaptation of subject matter or methods of teaching to the various groups and better results are expected solely by the simple device of grouping. In many experiments it is assumed that the same materials and methods be used in the experimental group as in the control group. To some it seems as necessary to keep materials and methods the same as to keep the ability of the students the same and to assure themselves that both experimental and control groups are taught by the same teachers or teachers of equal ability.

A number of difficulties arise which eventuate in criticism of the sort found in the Ninth Yearbook, and of the sort which Dr. J. R. McGaughey has frequently mentioned. In the first place, although homogeneous groups may be formed which have less variability than have heterogeneous groups, it is obviously impossible to organize groups which are strictly homogeneous—every group will have some variability. This variability will be of two sorts: (1) that arising from differences between pupils, and (2) that arising from uneven development (special abilities and disabilities) of individual pupils. Because of these variations there inevitably will be a range of achievement in each group and an overlapping between groups, and we will naturally raise a question as to whether we are not setting up distinctions which are too artificial.

If one reviews the important studies relating to grouping it will be found that a very large percentage of them has assumed, explicitly or implicitly, some of the positions just mentioned. Whether the groups are formed by the use of intelligence tests or achievements tests they are

evaluated in terms of gain in achievement in particular subjects. The question which is faced when achievement tests are used is what type of test to use. In the high school this matter is possibly somewhat easier than in the grades. If a class in algebra is to be divided into ability groups we may use an algebra test, but in the grades, except in departmental work, ability groups in each subject are not feasible. Even when groups are formed in single subjects it is frequently found that such tests are not indicative of the amount of progress which different pupils may make. Some pupils with low initial achievement make large gains, others do not.

All of these considerations would seem to lead us to say that homogeneous grouping, as above defined, when carried out strictly according to its intent, that is, decreasing variability for the purpose of increasing achievement, does not lead to the desired results and that in the very nature of the situation it can not. It should be noted also that several assumptions have been made which are not in accord with the best type of education. Subject matter achievement, while having the sanction of tradition and while greatly facilitating marking and determining promotion, is but one, and possibly a minor one, of the results which should be expected of education. There probably was a time several hundred years ago, when the memorization of facts was of tremendous social and economic value. The facts which were good for one generation were good for the next. Progress was slow. Now, however, what seem to be valuable facts to-day may be abandoned tomorrow, and the only residue left from the learning of facts is a technique for obtaining any new facts that may be necessary. In other words, it would seem that to-day when things are moving very rapidly it is not so much subject matter we need to stress but rather the techniques by which we may obtain information to solve our problems and develop habits of working, attitudes toward people and toward problems, character, personality and other more or less intangible results. Subject matter becomes a means to an end and not an end in itself.

There is nothing new in this statement. The progressive education movement stresses it. Activity periods, project methods and all of the other devices which have come into being in recent years, are attempts to break away from old subject matter limitations and to create in the pupil new interests, new habits and new traits which are socially valuable. What we need to-day is to think carefully how these newer values in education will be affected by an improved method of grouping pupils.

This leads to consideration of the second type of grouping, which we have chosen to call "ability grouping." The formation of ability groups may be identical with homogeneous groups, that is, both may be formed on the basis of intelligence tests or on the basis of a composite score from a number of achievement tests, but not upon achievement tests in one subject. However, as defined here, ability grouping is differentiated from homogeneous grouping largely by its different aim or purpose. Ability grouping aims at a better orientation on the part of the pupils with life in general, and not at superior achievement in particular subjects as does homogeneous grouping. The purpose is not realized in a half year, or in a year, but rather over a period of years. In general, its aim is to anticipate the social group in which the boy or girl will find himself when he leaves school. More specifically the aims are those of the progressive education movement.

Under this type of grouping, adjustment of subject matter and of method to the group which is being taught is of first importance. The teaching of a standardized body of subject matter is not an aim. The subject matter is used merely as a vehicle for the training of qualities essential in our present civilization. It is for this reason, therefore, that no standard achievement is to be expected of any of the groups. The teacher is left free to select those materials which will contribute to the ends desired. May it be repeated that *the point of differentiation between homogeneous grouping and ability grouping is that the former is looked upon as a device for improved achievement in certain standardized subject matter, whereas the latter is for the purpose of developing certain more general abilities, and that subject matter is used merely as a means to this end.*

Problems which arise from ability grouping are numerous, much more numerous than those involved in homogeneous grouping. This is largely because new principles are involved concerning which there is not universal agreement at the present time. We are not entirely ready to abandon the mastery of a minimum amount of subject matter as an aim. Superintendents will say that if this is not required, teachers will lie down on the job. We do not yet know well enough how to measure the sort of results which are here discussed as the desirable aims of ability grouping. Until we have adequate scales in the fields of character, attitudes, personality, habits of study, etc., it will be difficult to evaluate ability grouping and progress will be slow. Also, this raises

another question: How far do specialized habits and attitudes carry over to out-of-school life?

Ability grouping, in the minds of many, runs counter to our ideas of democracy. Many will justify a grouping which is for the purpose of higher achievement of every individual, but to classify with the expectation that the groupings will be permanent arouses opposition. A notion is current that every boy or girl who has sufficient persistence and ambition can achieve any goal. These two traits have an extraordinarily high value, it is true, but they are not the sole determinants of one's future. But even these traits would have a much better chance of development in ability groups where the expectation held before each pupil is within the range of his ability. There are all sorts of other difficulties which must be faced before a system of ability grouping is a success.

The distinction which we have attempted to make between homogeneous and ability grouping should lead research workers and school administrators to great care in planning experiments and in evaluating an organization involving grouping. In such planning and evaluation the two types of grouping should be differentiated. If this is done much clearer thinking and much more helpful results should soon be available.

EXTROVERSION AS A FACTOR CONDITIONING ACHIEVEMENT IN THE FIFTH AND SIXTH GRADES OF THE ELEMENTARY SCHOOL

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SEVERAL studies have indicated that the introvert succeeds better academically in high school and college than does the extrovert.[1] Exaggeration of the thought processes at the expense of overt social behavior, which is the major characteristic of the typical introvert, according to Freyd,[2] seems rather naturally to go with relatively high success in the pursuit of book knowledge. However, the theoretical literature on introversion-extroversion does not favor the introvert above the extrovert from the standpoint of generally desirable personality, and in fact is inclined to give preference to the extrovert or to the so-called ambivert.

The major problem of the present investigation is to determine whether the relationship between introversion-extroversion and school success, as found for secondary and higher education, holds for fifth- and sixth-grade elementary school children. Minor problems are to determine a satisfactory method of measuring extroversion (this term will be used hereafter in place of the double term, introversion-extroversion) for intermediate grade pupils; to study sex differences in extroversion, at this school level; to determine in detail the relationships, for fifth- and sixth-grade pupils, between age, intelligence, extroversion, and achievement; and to study sex differences in the relationships between these factors.

Technique and Procedure.—The subjects of this investigation were 120 pupils, 48 boys and 72 girls, in the fifth and sixth grades of a public

[1] Heidbreder, E. "Measuring Introversion and Extroversion," *Journal of Abnormal and Social Psychology*, XXI (1926), pp. 120-134.
Powers, N. E. "An Application of the Marston Introversion-Extroversion Rating Scale," *Journal of Educational Psychology*, XIX (1928), pp. 168-174.
Young, J. B. "How Emotional Traits Predispose to College Failure," *Journal of Educational Psychology*, XVIII (1927), pp. 631-636.

[2] Freyd, M. "Introverts and Extroverts," *Psychological Review*, XXXI (1924), pp. 74-87.

school serving a middle-class urban population in Covington, Kentucky. Each of these was given six independent ratings for extroversion, and was measured for intelligence and achievement by standardized tests which have been widely used.

The principal of the school, the classroom teachers of the subjects, and the general substitute teacher for the school, who is also the principal's assistant, rated the children by the Marston Rating Scale for Introversion-Extroversion, following closely the procedure of its originator.[3] Three ratings by adults were thus secured. In addition, each child was rated by two classmates of the same sex, and rated himself, by the Freyd Check List of Introvert Traits, as used by Heidbreder.[4] This list of traits was slightly modified in the direction of simplicity of language.

The measure of intelligence was secured by the Otis Self-Administering Test of Mental Ability, Intermediate Examination, Form A. This yields a score from which are readily derived the approximate mental age and I.Q., by Otis' procedure. This test requires thirty minutes of working time.

The Public School Achievement Tests, Battery A, Form 1, prepared by Orleans, were used to measure pupil achievement. These tests cover reading, arithmetical computation, arithmetical reasoning, language usage, and spelling, and require one hundred eighty minutes of working time. The composite score yielded by these tests was used as a general measure of school achievement.

The relationships between extroversion and the other factors considered were studied in two ways: first, by classifying the subjects on the basis of the extroversion ratings as extroverts, ambiverts, or introverts, and determining differences between these groups; second, by the use of simple and partial correlations.

Evaluation of Extroversion Ratings.—Each of the extroversion rating scales used had been studied as to validity by previous investigators, but it remained to determine their reliability as applied in this investigation. In general, it is assumed that independent ratings of the same

[3] Marston, L. R. "The Emotions of Young Children," *Iowa Studies in Child Welfare*, Vol. III, No. 3, 1925.

[4] Heidbreder, E. "Measuring Introversion and Extroversion," *Journal of Abnormal and Social Psychology*, XXI (1926), pp. 120-134.

subjects are reliable insofar as they show substantial agreement. In Table I are shown intercorrelations of the ratings by various judges, for all the subjects considered together.

TABLE I

CORRELATIONS OF EXTROVERSION RATINGS OF 120 SUBJECTS, BY THE VARIOUS JUDGES

	r	P.E.
Substitute with Teacher	+.752	.027
Principal with Teacher	+.673	.033
Principal with Substitute	+.651	.036
Self with All Other Judges	+.238	.058
Self with 1st Pupil Judge	+.211	.059
Adults with Pupils and Self	+.175	.059
Adults with Fellow Pupils	+.141	.060
Adults with Self	+.140	.060
Self with 2nd Pupil Judge	+.080	.061
1st Pupil Judge with 2nd Pupil Judge	—.028	.061

The correlations between the ratings of adult judges are high enough to indicate considerable reliability. None of the ratings by the children shows much agreement with other ratings. The self-ratings are more significant than the ratings by fellow pupils.

Under the conditions of this study, the Marston Rating Scale is a fairly reliable instrument for use by adults in judging fifth and sixth grade children. Little confidence can be placed in ratings made on the basis of Freyd's Check List by pupils of these grades. This statement holds whether the pupils are being judged by themselves or by others.

For the purposes of this investigation, a composite of the three adult ratings was used as the one best measure of extroversion. A technique devised by Hull[5] and reported by Garrett[6] was employed to secure a composite in which the ratings used would be weighted equally. All composite ratings involved in the correlations of Table I and in the later tables were obtained by this procedure.

Description of Subjects in Terms of the Measures Used.—In Table II are reported the means and standard deviations of the distributions of the subjects by age, intelligence, and achievement. Chronological age and mental age are reported in months. The I. Q. was obtained by the method prescribed by Otis. The intelligence scores and achievement scores are in terms of the original test data.

[5] Hull, C. "The Conversion of Test Scores into Series Which Shall Have Any Assigned Mean and Degree of Dispersion," *Journal of Applied Psychology*, VI (1922), pp. 298-300.

[6] Garrett, H. E. *Statistics in Education and Psychology.* New York: Longmans, Green & Company, 1926.

TABLE II

THE MEANS AND STANDARD DEVIATIONS OF CHRONOLOGICAL AGE, INTELLIGENCE, AND ACHIEVEMENT SCORES OF BOYS AND GIRLS SEPARATELY AND COMBINED

		C. A.	(Otis) M. A.	(Otis) I. Q.	(Otis Test) Int. Score	Ach. Score
48 Boys	M.	141.69	139.71	98.15	33.77	209.79
	S.D.	11.95	24.90	12.65	12.10	37.60
72 Girls	M.	145.75	135.06	93.18	31.30	211.67
	S.D.	15.20	22.60	15.25	11.75	34.30
120 Subjects (Boys and Girls)	M.	144.12	137.08	95.17	32.25	210.92
	S.D.	14.80	23.70	14.45	11.90	35.70

The girls average four months older than the boys in chronological age and four months younger in mental age, but their achievement is as high as that of the boys. The general level of achievement is close to the norm given by Orleans for the 6A grade (213).

In Table III are given the means and standard deviations of the ratings for extroversion. These have been calculated in terms of the converted ratings.

TABLE III

THE MEANS AND STANDARD DEVIATIONS OF EXTROVERSION RATINGS OF ADULTS AND PUPILS

		Principal	Substitute Teacher	Teacher	1st Pupil	2nd Pupil	Self
48 Boys	M.	52.10	54.08	51.27	50.64	48.98	52.52
	S.D.	13.30	13.45	13.30	14.50	12.80	13.60
72 Girls	M.	47.97	46.44	47.48	47.00	48.73	45.61
	S.D.	13.80	15.10	14.05	13.50	14.60	13.90
120 Subjects (Boys and Girls)	M.	49.68	49.50	49.00	48.46	48.83	48.33
	S.D.	13.65	14.95	13.85	14.05	13.55	14.20

The data in this table indicate that the boys are on the whole more extroverted than the girls, but are somewhat less variable than the girls as to this trait. The various ratings show close agreement as to both of these points.

Differences Between Extroverts, Introverts, and Ambiverts.—On the basis of the adult extroversion ratings, the subjects were divided into three equal groups. The upper third will be referred to as extroverts, the middle third as ambiverts, and the lower third as introverts. Such designation is in accord with the assumption that these terms are strictly speaking only relative, both extroversion and introversion being simply extremes of a single scale. Similar divisions were made within the groups of boys and girls, to reveal sex differences in the relationships studied.

The results for the 48 boys are presented in Table IV. In chronological age, differences are not conspicuous, although the extroverts average slightly younger than either the introverts or the ambiverts. In intelli-

TABLE IV

COMPARISON OF MEAN CHRONOLOGICAL AGE, INTELLIGENCE, AND ACHIEVEMENT SCORES OF 48 BOYS GROUPED AS INTROVERTS, EXTROVERTS, AND AMBIVERTS

	Subjects	Mean C. A.	Mean M. A.	Mean Intell. Score	(Otis) Mean I. Q.	Mean Achievement Score
Introverts	16	143.5	134.5	31.1	94.9	192.7
Extroverts	16	138.1	137.6	33.0	98.9	212.5
Ambiverts	16	143.3	150.2	37.7	100.7	222.0

gence, the results show a tendency for the extroverts to surpass the introverts, although the ambiverts surpass both of the extreme groups. Exactly the same tendencies appear for achievement, the superiority of the extroverts over the introverts and of the ambiverts over both the other groups being clearly marked.

TABLE V

COMPARISON OF MEAN CHRONOLOGICAL AGE, INTELLIGENCE, AND ACHIEVEMENT SCORES OF 72 GIRLS GROUPED AS INTROVERTS, EXTROVERTS, AND AMBIVERTS

	Subjects	Mean C. A.	Mean M. A.	Mean Intell. Score	(Otis) Mean I. Q.	Mean Achievement Score
Introverts	24	152.7	129.6	28.5	88.1	205.8
Extroverts	24	144.7	135.2	30.9	93.2	209.5
Ambiverts	24	139.8	141.4	34.3	99.1	219.5

Corresponding results for the 72 girls are presented in Table V. Age differences are more marked than for the boys. The introverts are older than the extroverts, and the extroverts older than the ambiverts. The over-aged girls apparently are inclined to be at one extreme or the other of the extroversion scale, and are more inclined to be introverted than to be extroverted. The averages for mental age, intelligence score, and I. Q. indicate that the introverts tend to be less intelligent than the extroverts, and considerably less than the ambiverts. In achievement, the introverts rate slightly below the extroverts, and the extroverts below the ambiverts.

The most significant findings for the girls are exactly similar to those for the boys. The ambiverts excel the extreme groups both in intelligence and achievement, but the extroverts are slightly above the introverts in both of these regards.

Similar tabulations of the results for the entire group of 120 subjects taken as a whole (not presented here) lead to the same conclusions. So far as these results go, it would appear that at the intermediate grade level it promises better for the scholastic success of a pupil for him to be extroverted than to be introverted, and better yet for him to be am-

biverted. The tendency for higher intelligence to go with ambiversion suggests also the possibility that a middle standing with reference to extroversion-introversion represents a more intelligent mode of adjustment to life than an extreme standing. Neither of these findings is in agreement with the results of previous studies made of high-school and college students.

Correlations Between Age, Intelligence, Extroversion, and Achievement.—A second treatment of the data is in terms of the partial correlation technique. This treatment neglects the possibility of differences between the upper, middle, and lower divisions of the subjects, such as have already been discussed, and is designed only to get at general tendencies to relationship.

In Tables VI and VII are presented respectively zero-order coefficients and second-order coefficients, for the relationships between intelligence, achievement, extroversion, and age. First-order coefficients, which are required merely for an intermediate step, are not presented. Only the second-order coefficients, reporting correlations between two factors with the other two factors held constant, need to be discussed. The procedure followed is that developed by Holzinger[7] and the notation is the customary one for partial correlation problems.

The measure of intelligence is the raw score on the Otis Test. The measure of achievement is the total achievement score on the Public School Tests. The measure of extroversion is the composite of the adult ratings. The measure of age is chronological age in months.

The smallest of the second-order coefficients for boys is −.213, for intelligence with age. All other coefficients for boys are larger than .30, and are probably significant of some degree of relationship.

TABLE VI

ZERO-ORDER CORRELATIONS BETWEEN INTELLIGENCE (X_1), ACHIEVEMENT (X_2), EXTROVERSION (X_3), AND AGE (X_4) FOR 48 BOYS AND 72 GIRLS

	Boys		Girls	
Index	r	P.E.	r	P.E.
r_{12}	+.853	.026	+.778	.031
r_{13}	+.077	.096	−.056	.078
r_{14}	+.280	.089	−.195	.076
r_{23}	+.265	.090	−.080	.078
r_{24}	+.394	.082	−.102	.078
r_{34}	−.133	.095	−.141	.076

[7] Holzinger, H. J. *Statistical Methods for Students in Education.* Boston: Ginn and Company, 1928.

TABLE VII

SECOND-ORDER CORRELATIONS BETWEEN INTELLIGENCE (X_1), ACHIEVEMENT (X_2), EXTROVERSION (X_3), AND AGE (X_4) FOR 48 BOYS AND 72 GIRLS

Index	Boys	Girls
$r_{12.34}$	+.860	+.776
$r_{13.24}$	−.342	−.019
$r_{14.23}$	−.213	−.187
$r_{23.14}$	+.460	−.046
$r_{24.13}$	+.407	+.073
$r_{34.12}$	−.317	−.151

For boys, the most significant results may be summarized in the statement that extroversion is positively related to achievement and negatively related to intelligence and age, other factors being kept constant in each case. Relationships ordinarily found between intelligence, achievement, and age, when subjects in a single grade or two adjacent grades are studied, maintain for this group of subjects.

The second-order coefficients for girls are very small, with the exception of the expected positive relationship between intelligence and achievement. It appears that for the girls, extroversion is unrelated to achievement or intelligence, and negatively related to age, but only to a very slight degree, other factors being kept constant in each case.

The partial correlation technique indicates general trends only, as was stated earlier. This procedure, of course, is not adapted to reveal the type of fact which has been reported concerning the sub-groups of extroverts, introverts, and ambiverts.

In one major respect, the correlation findings agree with the group comparisons. The hypothesis that introversion is positively correlated with achievement is certainly not tenable for the fifth- and sixth-grade children studied.

The lack of relationship between extroversion and the other factors for girls and the negative correlation between extroversion and intelligence for boys are rather surprising, in view of the group comparisons. It must be remembered that more factors have been kept constant by the partial correlation technique than in the group comparisons, and hence that complete agreement is not to be expected.

CONCLUSIONS

Partial correlations indicate that extroversion is positively related to achievement and negatively related to intelligence for boys in the fifth and sixth grades, and is practically unrelated to these factors in the case of girls. When the pupils who are at neither extreme of introversion

or extroversion are sorted out, however, they are found to surpass both extremes in achievement and intelligence.

It may be concluded that it probably augurs better for school success in intermediate grades to be ambiverted than to be either introverted or extroverted. Whatever may be the case in high school or college, introversion is no advantage to fifth- and sixth-grade boys and girls, from the standpoint of academic achievement.

This study suggests possibilities of interest to teachers and administrators. (1) Ratings on a carefully prepared scale, such as the Marston Scale, can be used successfully by teachers and administrators for such personality traits as extroversion. (2) The traits which have been characterized by psychologists and psychiatrists as introverted and extroverted probably do not make for as good academic adjustment as traits intermediate between these extremes. (3) Teachers and administrators may therefore properly study possibilities of developing personality along lines of normal adjustment to the world of things and people, such adjustment not being represented by the extreme of introversion or by the extreme of extroversion.

DIFFERENTIAL PREDICTION OF ABILITY AS REPRESENTED BY COLLEGE SUBJECT GROUPS*

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INTRODUCTION AND STATEMENT OF PROBLEM

THE problem of predicting scholastic success has been the subject of considerable thought and investigation since the advent of measurement in the field of education. The problem is now more pertinent than ever owing to the rapid development of public education through the enforcement of compulsory education and the upper extension of education in the junior college. This change in public education is in line with our recognition of our responsibility for creating the opportunity for all children to develop to the limits of their ability.

The prediction of scholastic success with the use of tests and measurements in education began with the correlation of marks made by pupils one year with the marks made in later years, as was done by Miles.[1] The advance was made by Kelley[2] through the use of the multiple regression equation. At first, teachers' marks were used and then later the results of tests and questionnaires were added as items for prediction. All such correlations and predictive equations have been directed towards two sorts of criteria. The one criterion of scholastic success has been the general average of a student's success in some one year or in an institution. The other criterion has been the success in some specific subject or group of subjects.

On account of the tendencies in the growth of education noted above, it seems desirable to add a new criterion of scholastic success to the two already listed. This criterion is the differential prediction of scholastic success. If all children must attend school for longer and longer periods of time it becomes more and more important that we know in what subjects any specific child is most likely to be successful. The prediction of general scholastic success is not always so important since children must attend school in any event. Once the fundamentals of education

*The study reported upon here was carried out under the direction of Dr. Truman L. Kelley at Stanford University.

[1] Miles, W. R. "Comparison of Elementary and High School Grades," *University of Iowa Studies in Education*, I, 1910.

[2] Kelley, T. L. *Educational Guidance.* Contributions to Education, No. 71. New York: Teachers College, Columbia University, 1914.

have been learned the important prediction is that a child will do better in one line than in another. This is called differential prediction, and the development of a method for this kind of prophecy is the problem we set out to solve. This proposition is somewhat analogous to the proposition of the discovery of individual idiosyncrasy[3] but is different in that our problem is a prediction rather than a present determination.

In the discussion of this point we have assumed that there are scholastic abilities that can be differentiated. We have not made this assumption in our work but have attempted to show the existence of these differing scholastic abilities in the field of our endeavor. There is some evidence that there are differentiable mental abilities in general,[4] but in the restricted field of our investigation it seemed necessary in order to direct our further work in the calculation of prediction equations, to establish independently, by some means, differentiable ability groups. Since we have chosen abilities on the college level as represented by college subject groups, we have made no attempt to establish the existence of the more elementary abilities in each college subject group, because of the complexity involved. Neither have we attempted to account for nature or nurture factors in the abilities represented by our college subject groups. The prediction of differential abilities in and of itself establishes a stability of the organization of abilities.

Our particular study involves the prediction of scholastic success at the college level, and we shall confine our brief survey, therefore, to studies on this level. There are no studies which can be compared directly with the results of our study since we are attempting to predict a difference, whereas other studies attempt to predict the success for single college subjects or for the average of several college subjects. Indirectly, however, we can compare the success in prediction in our own province with that of success in other sorts of prediction.

The fundamental measure used as a basis for determining prediction is the correlation existing between the material used for prediction and the measure of success in the particular thing to be predicted. The material used for prediction may be ratings, test scores, answers to questionnaires, etc. The search has been, therefore, for suitable ratings, tests, etc., which will give the highest correlations with the criteria and

[3] Kelley, T. L. *Interpretation of Educational Measurements.* (Yonkers, New York: World Book Company, 1927), Chapter V.

[4] Kelley, T. L. *Crossroads in the Mind of Man.* Stanford University Press, 1928. Spearman, C. *Abilities of Man.* New York: The Macmillan Company, 1927.

the search for methods for combining such ratings, test scores, etc., so that a high correlation with the criteria will result. The criterion of success in our study is the difference between mean marks made in various college subject groups. Marks have been used almost exclusively as criteria of success in college. With more careful achievement testing at this level no doubt college success will become better defined.

The studies of Whitman,[5] Root,[6] the Thurstones[7] and Gowen and Gooch,[8] give typical results of the relationship between college success and other factors using zero order coefficients of correlation. The studies of Odell[9] and that of the Modern Language Survey[10] give typical results of the relationship between college success and other factors using the multiple regression equation technique.

It seems that according to the best investigations on the subject, zero order coefficient of correlation between an item and the general criterion of college success or the criterion of a single college subject are less than .50 and that the coefficients of correlation obtained by the multiple regression method between items and any criterion of college success when the items are well chosen are less than .60. The correlations usually obtained in investigations of college prediction run somewhat lower than the correlations mentioned.

These correlations indicate that there is much to be desired as far as accurate guidance of college students is concerned. The measurement of other factors than that of achievement and general ability is as yet unsatisfactory. Until interests, character traits, etc. can be measured with some degree of facility very high predictions of college success probably cannot be made. We have, in our study, made use of a measurement of interest.

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[5] Whitman, A. D. *The Value of the Examinations of the College Entrance Examination Board as Predictions of Success in College.* New York: Bureau of Publications, Teachers College, Columbia University, 1926.

[6] Root, A. T. "The Freshman: Thorndike College Entrance Tests, First Semester Grades, Binet Tests," *Journal of Applied Psychology,* VII (March, 1923), pp. 77-92.

[7] Thurstone, L. L., and Thurstone, Thelma Gwinn. "The 1929 Psychological Examination," *Educational Record,* XI (April, 1930), pp. 101-128.

[8] Gowen, J. W., and Gooch, M. "The Mental Attainments of College Students in Relation to Previous Training," *Journal of Educational Psychology,* XVI (November, 1925), pp. 547-560.

[9] Odell, C. W. "Predicting the Scholastic Success of College Freshmen," *College of Education Bulletin,* No. 37. (Urbana, Illinois: Bureau of Educational Research, University of Illinois, 1927), page 33.

[10] *Prognosis Tests in the Modern Foreign Languages.* Publications of the American and Canadian Committees on Modern Languages. (New York: The Macmillan Company, 1929), Volume XIV.

GENERAL OUTLINE OF PROCEDURE AND ORIGINAL DATA

The differential prediction of college success in this investigation means the prediction of a difference of success in pairs of college subject groups. The difference in success is measured by the difference in marks made by the two college subject groups. For instance in physical science subjects a student may make an average or mean mark of 2.4 whereas in biological science subjects the same student may make a mean mark of 3.1. The difference in marks between these two college subject groups is .7 in favor of physical science. We set ourselves the development of a method of predicting such differences.

Differential prediction will not predict college success in general. Therefore, in some guidance situations it may be necessary to apply a measure of general scholastic ability. Differential prediction does not set itself up to take the place of the direct prediction of ability.

The problem divided itself into three parts. First, we established the existence of differentiable mental abilities as represented by certain college subject groups. Second, we developed the formula necessary to predict the differences of success between college subject groups and the standard error of this formula. Third, we illustrated the use of the formula as a practical instrument of prediction.

THE DATA

About 200 graduating seniors (class of 1925, Polytechnic High School, Long Beach, California) who notified the registrar's office that they expected to attend college were given the following tests and questionnaires: Van Wagenen Reading History Scale A; Cross English Test Form A; Illinois Standardized Algebra Test; Stanford Interest Report Blank (also called the Cowdery Interest Questionnaire)[11]; and Wyman Association Test for Interests.

These particular tests were selected as being possible items valuable in the differentiation of success in different college subject groups. The first three are too well known to warrant extended comment. The Stanford Interest Blank was one developed by Dr. Cowdery.[12] It can be

[11] This questionnaire was later revised and extended in form by Dr. Edward K. Strong, Jr.

[12] Cowdery, Karl M. *An Evaluation of the Expressed Attitudes of Members of Three Professions: Medical, Engineering, and Legal.* Ph. D. Thesis, Stanford University. (Unpublished).

scored in three different ways. Scoring it with one key gives the result a positive correlation with interest and ability in law. By scoring it another way it gives a positive correlation with interest and ability in medicine and a third scoring gives it a positive correlation with interest and ability in engineering.

The other test, the Wyman Association Test for Interests,[13] has been omitted from further consideration owing to the fact that when the reliability coefficient was calculated it was found to be nearly .00 for the three interests it was supposed to measure. This test was made, originally, for pupils at the upper elementary school level and this fact probably is responsible for its lack of reliability at the upper senior high-school level.

The records made by these students in their college work were obtained insofar as was possible. The records for the academic years 1925-26 and 1926-27 were asked for and used. College records for 97 students were found to be usable in our study out of 115 reports on students. We believe we were able to obtain the reports on over 95 percent of the students enrolling in colleges during the two years above mentioned from the original group of 200 that were tested. The college records were analyzed for subjects which seem to fall into natural ability groups.

Practically all of the students whose records are used in this study attended colleges and universities in Southern California.

THE DIFFERENTIATION OF THE ABILITIES AS REPRESENTED BY THE MARKS MADE IN CERTAIN COLLEGE SUBJECT GROUPS

After considerable preliminary investigation in the differentiation of various college subject groups the following were finally determined upon as giving the best possibilities: English; languages; economics; history; biological science; and physical science.

The language group included all foreign languages. It was composed mostly, however, of French, Spanish, and German. The other subject groups are self-explanatory. From the marks in the six subject groups we calculated the reliabilities of and the intercorrelations between the groups. The raw data for this work were given in the following form:

Student	Languages	History	Economics	Biological Science	Physical Science	English
E. B.	3 CCC	3.5 CD	3 C	3 C	3.3 DCC	2.7 CCBC

[13] Wyman, Jennie Benson. *On the Influence of Interest on Relative Success.* Ph. D. Thesis, Stanford University. (Unpublished).

Each letter is the mark in some particular subject in that subject group. To find mean marks the system was adopted where A=1, B=2, C=3, D=4, and all failure marks or F's=5. The reliability of the single marks in each subject is given in Table I. All the coefficients of correlation reported in Table I and in the tables following are based on various sized populations taken in all cases from the records of the 97 students for whom we have college records. In some cases, overlapping populations have been used where identical populations would have been more desirable because they would have made certain correlations higher. We have given for most of the tables the range of P. E.'s.

TABLE I

THE RELIABILITIES OF THE INDIVIDUAL MARKS IN COLLEGE SUBJECT GROUPS

Languages	.664
Economics	.571
History	.370
Biological Sciences	.606
Physical Sciences	.519
English	.406

The P. E.'s for this table have a range of .02 to .06.

TABLE II

INTERCORRELATIONS BETWEEN COLLEGE SUBJECT GROUPS USING INDIVIDUAL MARKS

	Economics	History	Biol. Science	Phys. Science	English
Languages	.217	.523	.392	.279	.517
Economics		.296	.436	.546	.187
History			.347	.165	.327
Biological Science				.415	.196
Physical Science					.320

The P. E.'s for this table have a range of .02 to .05.

TABLE III

INTERCORRELATION COEFFICIENTS CORRECTED FOR ATTENUATION

	Economics	History	Biol. Science	Phys. Science	English
Languages	.352	1.054	.618	.475	.996
Economics		.643	.741	1.004	.388
History			.734	.377	.845
Biological Science				.741	.395
Physical Science					.697

Table II gives the intercorrelations between the college subject groups using individual marks. All the correlations reported in Tables I to III, inclusive, have been calculated by the Pearson product moment method, corrected for broad categories.[14]

[14] Kelley, T. L. *Statistical Method.* (New York: The Macmillan Company, 1923), page 167.

We now had the data available for making a good estimate of the existence of differentiable groups of college subjects among the particular ones investigated. This was done by the application of the formula for the correction for attenuation[15] of the correlations reported in Table II. These correlations are reported in Table III.

These correlations represent estimates of the true correlation as to success between these college subject groups when measured by the individual marks since they are correlations resulting when the inadequacies of the measuring instrument have been taken into account and allowed for. These correlations corrected for attenuation differ considerably. Any pair of college subject groups that produce a correlation near 1.00 indicates that the abilities involved in the two groups were nearly the same and that therefore no differentiation can be expected. A consideration of the table led us to set down as differentiable the following pairs of subject groups: languages and economics; languages and biological science; languages and physical science; economics and history; economics and biological science; economics and English; history and biological science; history and physical science; biological science and physical science; biological science and English; and physical science and English.

THE DEVELOPMENT OF THE DIFFERENTIAL PREDICTION FORMULA AND ITS PROBABLE ERROR AND THE CALCULATION OF THE DIFFERENTIAL PREDICTION EQUATIONS

Let X_1, X_2, X_3, etc., denote the scores on the tests and questionnaires used with the graduating high-school students and let X_L, X_{Ec}, X_B, etc., denote the marks made in the different subjects. If we then determine $X_L - X_{Ec}$, $X_L - X_B$, etc., we have differences which we shall call X_d. The problem of prediction then becomes one of finding $\overline{X}_d$, or in other words to find the estimated true differences, and also to find the probable error of $\overline{X}_d$ from which the accuracy of the prediction can be judged.

To find $\overline{X}_d$ requires the use of the regression equation. The regression equation is in general

$$\overline{X}_0 = b_{01.23.....n} X_1 + b_{02.13.....n} X_2 ..... + b_{0n.12.....(n-1)} X_n + C^*$$

[15] Kelley, T. L. *Statistical Method.* (New York: The Macmillan Company, 1923), page 204, formula 155.

* Kelley, T. L. *Statistical Method.* (New York: The Macmillan Company, 1923), page 283, formula 249.

and $C = M_o - b_{01.23.....n} M_1 .....$
$- b_{on.12.....(n-1)} M_n$**

Therefore the regression equation for $\overline{X}_d$, i.e., the best estimate of a difference in marks in two subject groups, will be as follows:

$$\overline{X}_d = b_{d1.23.....n} X_1 + b_{d2.13.....n} X_2 .....$$
$$+ b_{dn.12.....(n-1)} X_n + C$$
$$\text{and } C = M_d - b_{d1.23.....n} M_1 - b_{d2.13.....n} M_2 ..... - b_{dn.12.....(n-1)} M_n$$

(Formula Number 1)

The standard deviation of the chance factor in $\overline{X}_d$ has been designated $\sigma_{d.1}$. The d in the subscript indicates that it is a standard deviation concerned with a difference and the i means that the standard deviation is that of an individual. To find this error we must consider the chance deviation in the score $\overline{X}_d$. The deviations in $\overline{X}_d$ comes from the deviations in X_1, X_2, etc., in the formula.

$$\overline{X}_d = b_{d1.23.....n} X_1 + b_{d2.13.....n} X_2 .....$$
$$+ b_{dn.12.....(n-1)} X_n + C \qquad (1)$$

Taking any two such equations considering that each $\overline{X}_d$ is equal to a true Score $X\infty_d$ plus an error designated as E_d
we get

$$X\infty_d + E_d = b_{d1.23.....n} X_1 + b_{d2.13.....n} X_2 ..... + C \qquad (2)$$
$$X\infty_d + E_d{}^1 = b_{d1.23.....n} X_1{}^1 + b_{d2.13.....n} X_2{}^1 + C \qquad (3)$$

Subtracting we get

$$E_d - E^1{}_d = b_{d1.23.....n} (X\infty + E_1 - X\infty - E_1{}^1)$$
$$+ b_{d2.13.....n} (X\omega + E_2 - X\omega - E_2{}^1) \text{ etc.} \qquad (4)$$

or

$$E_d - E_d{}^1 = b_{d1.23....n} (E_1 - E_1{}^1) + b_{d2.13....n} (E_2 - E_2{}^1) \text{ etc.} \qquad (5)$$

Summing such differences, squaring and dividing by N, we get

$$2\,\sigma^2_{d.1} = 2\;\; b^2_{d1.23.....n}\,\sigma^2_{1.1} + 2\; b^2{}_{d2.13.....n}\,\sigma^2_{2.1} ..... \text{ etc.} \qquad (6)$$

or

$$\sigma^2_{d.1} = b^2_{d1.23.....n}\,\sigma^2_{1.1} + b^2{}_{d2.13.....n}\,\sigma^2_{2.1} ..... \text{etc.} \qquad (7)$$

Since

$$\sigma^2_1 = \sigma^2\infty + \sigma^2_{1.1} \text{ and } \sigma^2_2 = \sigma^2\omega + \sigma^2_{2.1} \text{ etc.} \qquad (8)$$

then

$$\sigma^2_{1.1} = \sigma^2_1 - \sigma^2\infty \text{ and } \sigma^2_{2.1} = \sigma^2_2 - \sigma^2\omega \text{ etc.} \qquad (9)$$

** *Ibid.*, page 283, formula 248.

but

$$\sigma^2\infty = \sigma^2_1 \; n_{1I} \text{ and } \sigma^2\omega = \sigma^2_2 \; n_{2II} \text{ etc.} \qquad (10)$$

therefore

$$\sigma^2_{1.1} = \sigma^2_1 - \sigma^2_1 \; r_{1I} \text{ and } \sigma^2_{2.1} = \sigma^2_2 - \sigma^2_2 \; r_{2II} \text{ etc.} \qquad (11)$$

or

$$\sigma^2_{1.1} = \sigma^2_1 \; (1 - r_{II} \text{ and } \sigma^2_{2.1} = \sigma^2_2 \; (1 - r_{2II}) \text{ etc.} \qquad (12)$$

Substituting these values of $\sigma^2_{n.1}$ in the equation in step (7) we get

$$\sigma^2_{d.1} = b^2_{d1.23.....n} \; \sigma^2_1 \; (1 - r_{1I}) + b^2_{d2.13.....n} \; \sigma^2_2 \; (1 - r_{2II}) \; ..... \; b_{dn.12.....(n-1)} \; \sigma^2_n \; (1 - r_{nN})$$

(Formula Number 2)[16]

We next proceeded to the development of the prediction equations for our data.

The zero order correlations with the criteria, i.e., the correlations of the test and questionnaire scores with the differences in marks in the pairs of subject groups selected are given in Table IV.

An inspection of this table reveals an interesting relationship between the Van Wagenen History Reading Test and relative success in the various college subject groups. The correlation coefficients in this table, whether positive or negative, give an indication of the success in the latter of each subject pair as against the former. The correlations for the various pairs with the reading test indicates that this test is more related to success in such subjects as economics, physical science, and biological science than it is to success in history. This relationship which was not anticipated seems to be, upon reflection, a probable and natural consequence. The Van Wagenen History Reading Test tests ability to get meaning from reading material. It can be seen that this ability may be more important in such subjects as the sciences and economics than in history because these subjects require attention to meaning in a high degree, whereas history, although requiring a degree of reading ability no doubt, has probably another factor which is very important. This factor is the general memory factor. Success in the sciences and economics may be associated more with ability to reason whereas success in history may be more associated with ability to recall. The interpretation given herewith is put forth as a reasonable explanation of the results to which attention has been called, and is in no wise intended to be final or conclusive.

In order to proceed with the calculations it was also necessary to obtain the intercorrelations between the test items and the reliabilities of

[16] I am indebted to Dr. T. L. Kelley for the derivation of this formula.

the test items. The reliabilities were calculated from our own data and therefore they cannot be compared directly to reliabilities published for these tests and questionnaires since our group is a somewhat selected group. In most cases our reliabilities will be found to be lower. Our reliabilities were found by splitting the tests in half and using the Spearman-Brown formula. The population in all cases for this purpose was fifty. The reliabilities are given in Table V. The intercorrelations are given in Table VI.

We next found the β regression coefficients or β constants and the multiple correlation coefficients for each of the college subject group pairs for which a difference was to be estimated. We omitted all items for the calculation of constants where the correlation with the criterion was less than .10 since in general such low correlations will result in little or no value in a regression equation. The β constants and the multiple correlation coefficients were calculated by the method of suc-

TABLE IV

CORRELATIONS OF DIFFERENT ITEMS WITH CERTAIN CRITERIA OF COLLEGE SUCCESS

CRITERIA Difference in marks received in	Reading	English	Algebra	Medicine	Law	Engineering
Language, Physics	.037	—.333	.195	—.219	—.236	.388
Language, Economics	.170	—.451	.147	—.140	—.122	.299
Language, Biol. Sc.	.155	.010	.150	—.031	—.287	.098
Economics, History	—.478	.152	—.316	.221	—.023	—.066
Economics, English	—.344	.057	—.029	—.005	.209	.000
History, Phys. Sc.	.325	.182	.186	.223	—.277	.232
Biol. Sc., English	—.046	.022	.122	—.257	.316	—.163
Phys. Sc., English	—.179	.122	.000	—.032	.357	—.061
Economics, Biol. Sc.	—.208	.151	—.042	.317	—.183	.000
History, Biol. Sc.	.325	.142	.075	.162	—.267	—.070
Biol. Sc., Phys. Sc.	.000	—.065	—.074	—.346	.214	.253

The P. E.'s for the correlations of greater than $\pm$ .100 for this table range from .08 to .10.

TABLE V

RELIABILITY OF TEST ITEMS USED IN THE PREDICTION STUDY

Van Wagenen Reading	.769
Cross English	.642
Illinois Algebra	.953
Cowdery Questionnaire Medicine	.431
Cowdery Questionnaire Law	.318
Cowdery Questionnaire Engineering	.465

TABLE VI

INTERCORRELATION COEFFICIENTS BETWEEN TEST ITEMS

	Cross English	Illinois Algebra	Cowdery Medicine	Cowdery Law	Cowdery Engineering
Van Wagenen Reading	.330	.204	—.012	—.015	—.007
Cross English		.062	.170	.060	.106
Illinois Algebra			—.164	—.165	.287
Cowdery Medicine				—.244	—.143
Cowdery Law					—.550

The P. E.'s for this table range from .05 to .07.

cessive approximations.[17] This method gives β constants and multiple correlation coefficients to any degree of accuracy required. We have calculated our multiple regression coefficients to within .001 of the optimum value. The β constants are therefore as accurate as necessary for the work involved. The pair economics and English have only two correlations with test and questionnaire items which are more than .10 and therefore we have omitted this pair in our further study. The β constants and the multiple regression coefficients are given in Table VII. The multiple correlation coefficients are in general very superior to the zero order coefficients of correlation between the various test items and the criteria. This is due to the low intercorrelations between the test items. If these intercorrelations were not low our multiple correlation coefficients would not be nearly as significant as they now are.

We have chosen a multiple correlation coefficient of .500 as a critical coefficient for determining whether or not we should set up prediction equations. This is of course arbitrary although it is a common practice

TABLE VII

REGRESSION COEFFICIENTS AND MULTIPLE CORRELATION COEFFICIENTS FOR PREDICTION PAIRS

Item	Languages and Phys. Sc.	Languages and Economics	Languages and Biol. Sc.	Economics and History
Reading Test		.394	.134	—.536
English Test	—.369	—.663	.087	.823
Algebra Test	.089	.014		—.205
Cowdery Medicine	—.086	.094	—.271	.126
Cowdery Law	.011	.221		
Cowdery Engineering	.428	.481		
Multiple Correlation Coefficient Resulting	.555	.694	.333	.632

Item	History and Phys. Sc.	Biol. Sc. and English	Phys. Sc. and English
Reading Test	.254		—.203
English Test	.172		.142
Algebra Test		.169	
Cowdery Medicine	—.342	—.202	
Cowdery Law	—.378	.214	.345
Cowdery Engineering	—.037	—.112	
Multiple Correlation Coefficient Resulting	.543	.400	.427

Item	Economics and Biol. Sc.	History and Biol. Sc.	Biol. Sc. and Phys. Sc.
Reading Test	.268	.304	
English Test	.206	.038	
Algebra Test			
Cowdery Medicine	.245	.098	—.203
Cowdery Law	—.133	—.245	.344
Cowdery Engineering			.414
Multiple Correlation Coefficient Resulting	.438	.432	.480

[17] Kelley, T. L. *Statistical Method.* (New York: The Macmillan Company, 1923), page 302.

to consider coefficients of less than .50 to indicate prediction efficiency too low to be of practical value. Even higher correlations may not bring about efficiency of a practical sort. It depends upon other factors in the situation. Since we are primarily concerned in establishing a method, we are not concerned here especially with establishing this line of demarcation. We find that there are four pairs of groups that have multiple correlation coefficients above .50. We have calculated the multiple regression equations for these four groups and the probable errors of the resulting predictive values. The equations and the probable errors were calculated by the use of formulae 1 and 2 as established at the beginning of this section.

The equation for predicting a difference in achievement as to marks between economics and history in favor of history is as follows:

$$\overline{X}_{d(Ec-H)} = -.474\ X_1 + .192\ X_2 - .138\ X_3 + .015\ X_4 + 24.5$$
$$\sigma_{d.1} = 2.53$$
$$P.E._{d.1} = 1.71$$

Similarly the predictive equations and the probable errors for the other three pairs of college subject groups were found to be as follows: Languages and economics in favor of economics

$$\overline{X}_{d(L-Ec)} = .391\ X_1 - .371\ X_2 + .010\ X_3 + .012\ X_4 + .018\ X_5 + .044\ X_6 + 26.4$$
$$\sigma_{d.1} = 4.29$$
$$P.E._{d.1} = 2.89$$

languages and physical science in favor of physical science

$$\overline{X}_{d(L-P)} = -.161\ X_2 + .037\ X_3 - .008\ X_4 + .001\ X_5 + .029\ X_6 + 36.3$$
$$\sigma_{d.1} = 2.19$$
$$P.E._{d.1} = 1.48$$

history and physical science in favor of physical science

$$\overline{X}_{d(H-P)} = .187\ X_1 + .087\ X_2 - .031\ X_4 - .029\ X_5 - .003\ X_6 - .2$$
$$\sigma_{d.1} = 2.65$$
$$P.E._{d.1} = 1.79$$

The reliability coefficients of these predicted measures may be obtained through the use of the formula[18] $\sigma_{d.1} = \sigma_d \sqrt{1 - r_{dD}}$ since we

[18] Kelley, T. L. *Statistical Method.* (New York: The Macmillan Company, 1923), page 222, formula 178a.

have $\sigma_{d.1}$ given herewith and σ_d is found in the original data used in calculating the zero order correlations between the differences in marks and the various test items. These reliability coefficients and the standard errors used in their calculations are as follows:

Prediction Pair	$\sigma_{d.1}$	σ_d	r_{dD}
Economics and History	2.53	7.47	.88
Languages and Economics	4.29	7.32	.65
Languages and Physical Science	2.19	5.73	.86
History and Physical Science	2.65	6.15	.81

We have, in this chapter, explained a new method for the prediction of differences of scholastic abilities on the college level. In the next chapter we shall explain the practical aspects of the problem, that is, the application of the equations established above to the actual prediction situation.

(To be continued in the February, 1932, issue of this magazine)

THE RELIABILITY OF THE ACCOMPLISHMENT QUOTIENT

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THE history of educational measurement has witnessed at least two major lines of development: the measurement of intelligence and the measurement of classroom achievement. Intelligence tests may be considered as attempts to measure an individual's capabilities to achieve. Achievement tests, on the other hand, endeavor to measure the amount of attainment in specific school subjects.

In the beginning, educators were content to deal separately with these two measures of an individual. As time went on, those interested in educational testing realized that a fair and valuable testing program must be one in which the results of achievement tests are compared with the results of mental tests. To be able to combine the two measures was to increase tremendously the significance of both. In the event that a combination could be made satisfactorily, answers to such significant questions as the following might be expected. How much educational achievement can we expect from a child possessed of a given degree of intelligence? Is the child of high intelligence accomplishing in his school work results commensurate with his ability to do? Is the difference between accomplishment and mental ability one that is inherent in the individual or inherent in the school situation? Is it possible to equate ability and achievement? May such a combined measure be used as an incentive to effort?

Various measures have been proposed by different writers for comparing achievement with capacity to achieve. Among the better known measures are the following: the "achievement quotient"[1] introduced by the authors of the Illinois Examination; Franzen's "accomplishment quotient";[2] Franzen's "accomplishment ratio";[3] Pintner's "difference";[4] Torgerson's efficiency quotient";[5] Symonds' "index of studious-

[1] Monroe, W. S., and Buckingham, B. R. "Illinois Examination: Teacher's Handbook." (Bloomington, Illinois: Public School Publishing Co., 1920), 31 pp.

[2] Franzen, R. H. "The Accomplishment Quotient of School Marks in Terms of Individual Capacity," *Teachers College Record*, XXI (November, 1920), pp. 432-40.

[3] Franzen, R. H. "The Accomplishment Ratio," *Teachers College, Columbia University Contributions to Education*, No. 125. (New York: Bureau of Publications, Columbia University, 1922), 59 pp.

[4] Pintner, Rudolph, and Marshall, Helen. "A Combined Mental-Educational Survey," *Journal of Educational Psychology*, XII (January, 1921), pp. 32-48.

[5] Torgerson, T. L. "The Efficiency Quotient as a Measure of Achievement," *Journal of Educational Research*, II (June, 1922), pp. 25-32.

ness and effort."[6] Terms synonymous with or very similar to achievement quotient and accomplishment quotient are: attainment ratio, achievement ratio, subject ratio, and educational ratio. It appears that the most commonly used of these various measures are the achievement quotient and the accomplishment quotient. No doubt the extensive use of the Illinois Examination and the Stanford Achievement Test have in part accounted for this. Odell,[7] in a critical study of the merits and demerits of the various proposed measures, recommends the use of the "achievement quotient." Both the achievement quotient, and the accomplishment quotient in its original meaning, are found by dividing the achievement age by the mental age. Scores on achievement tests are converted into achievement ages by means of tables obtained in standardization. Mental ages are similarly obtained from an intelligence test.

Individual diagnosis is the primary purpose for which the accomplishment quotient, or any other index of the relationship between achievement and capacity to achieve, is intended. To perform this function adequately demands of any measure a high degree of reliability. Several writers have challenged very critically the accomplishment and achievement quotient techniques from this point of view. In the main, these writers have confined their attacks to the consideration of statistical limitations and the treatment of empirical data. Toops and Symonds,[8] Chapman,[9] Ruch,[10] Beeson and Tope,[11] Herring,[12] and Foran,[13] have indicated that for a quotient to be reliable it must be derived from in-

[6] Symonds, P. M. *Measurement in Secondary Education.* (New York: The Macmillan Company, 1927), pp. 521-25.

[7] Odell, C. W. "A Critical Study of Measures of Achievement Relative to Capacity," *University of Illinois Bulletin,* XXVI (March 19, 1929), pp. 21-34.

[8] Toops, H. A., and Symonds, P. M. "What Shall We Expect of the A. Q.?" *Journal of Educational Psychology,* XIII (December, 1922), pp. 513-28; XIV (January, 1923), pp. 27-38.

[9] Chapman, J. C. "The Unreliability of the Difference Between Intelligence and Educational Ratings," *Journal of Educational Psychology,* XIV (February, 1923), pp. 103-8.

[10] Ruch, G. M. "The Achievement Quotient Technique," *Journal of Educational Psychology,* XIV (September, 1923), pp. 334-43.

[11] Beeson, M. F., and Tope, R. E. "The Educational and Accomplishment Quotients as an Aid in the Classification of Pupils," *Journal of Educational Research,* IX (April, 1924), pp. 281-92.

[12] Herring, J. P. "The Reliability of Accomplishment Differences," *Journal of Educational Psychology,* XV (November, 1924), pp. 530-38.

[13] Foran, G. T. "The Meaning and Limitations of Scores, Norms, and Standards in Educational Measurement," *Educational Research Bulletin,* Catholic Education Press, III (February, 1928), pp. 16-19; 23-26.

telligence and achievement tests that are themselves reliable. It is statistically sound that a quotient will tend to be more unreliable than either of the two tests from which it is derived. Most of the intelligence and achievement tests possess reliabilities below that considered essential for individual diagnosis.

Only three published studies are known to the writer in which actual accomplishment quotient series were correlated to determine accomplishment quotient reliability. Symonds[14] using the National Intelligence Tests, the Thorndike-McCall Reading Scale, and the Woody-McCall Mixed Fundamentals in Arithmetic, reports reliability coefficients between achievement ratios, derived from first and second forms, varying from .23 to .60 with probable errors of 6 or 7 points. Popenoe[15] using the National Intelligence Tests, Woody-McCall Arithmetic Tests, Thorndike-McCall Reading Scale, and the Buckingham Revision of the Ayres Spelling Scale, on 600 pupils from grades three to eight, reports a reliability coefficient of .28 for the accomplishment quotient with a probable error of about six points. Odell[16] obtained data on the reliability of the accomplishment quotient from two groups of pupils. Over 200 fourth grade pupils were given both forms of the National Intelligence Test, Scale A, and Forms A and B of the Arithmetic Examination of the Stanford Achievement Test. A second group of approximately 800 eighth-grade pupils were given the Illinois General Intelligence Scale, Forms 1 and 2. Half of this second group took Forms 1 and 2 of Test II of the Monroe Standardized Silent Reading Test, Revised. The other half took Forms 1 and 2 of the Monroe General Survey Scale in Arithmetic. The obtained accomplishment quotient reliability coefficients varied from .39 to .58. A study of the probable errors of measurement showed them to amount to about one-tenth of the mean scores. Odell concludes that achievement quotients based upon a single administration of the tests are so much in error that their use for individual diagnosis is rarely if ever justified.

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[14] Symonds, P. M. "The Accuracy of Certain Standard Tests for School Sectioning and Marking," *Journal of Educational Psychology*, XV (October, 1924), pp. 423-32.

[15] Popenoe, Herbert. "A Report of Certain Significant Deficiencies of the Accomplishment Quotient," *Journal of Educational Research*, XVI (June, 1927), pp. 40-47.

[16] Odell, C. W. "A Critical Study of Measures of Achievement Relative to Capacity." *University of Illinois Bulletin*, XXVI (March 19, 1929), pp. 44-46.

The study here presented was undertaken to provide additional data on the reliability of the accomplishment quotient. Its purpose is two-fold:

1. To determine the reliability of the accomplishment quotient as derived from the weighted tests of the Stanford Achievement battery.
2. To determine if possible the factors which most influence the reliability of the accomplishment quotient and the way in which they do influence its reliability.

A beginning seventh grade in the St. Cloud, Minnesota, Junior High School, consisting of 132 students, was given both Forms A and B of the Stanford Achievement Tests and Forms A and B of the Terman Group Test of Mental Ability. These tests were given the last week of September and the first week of October, 1928. Due to absences during the testing period, only 110 pupils took both forms of all tests given. That these pupils were a rather typical seventh grade group is indicated by Table I below.

TABLE I

A Comparison of the Chronological, Mental, and Educational Ages of 110 Seventh Grade Junior High School Pupils, St. Cloud, Minnesota

Ages	Mean	Range	S.D.
Chronological Age (Months)	152.2 ±.82	73	12.82 ±.58
Mental Age (Months)	153.46 ±.72	46	11.22 ±.51
Educational Age (Months)	148.66 ±.72	56	11.25 ±.51

The mean, range, and S.D. of the chronological, mental, and educational ages of the pupils concerned in this study are similar to those reported for other seventh grade groups in various school surveys.

The raw scores on the Stanford Achievement Tests were converted into educational ages. The raw scores on the Terman Group Tests of Mental Ability were converted into equivalent Binet Mental Ages. Accomplishment quotients were obtained by dividing educational ages by mental ages. Six accomplishment quotients were obtained for each pupil in the following manner:[17]

[17] Three other accomplishment quotients might have been obtained for each pupil: dividing the average Stanford A and B educational age by the Terman A mental age; by the Terman B mental age; by the average Terman A and B mental age. Because of the length of time required to give and score the Stanford Achievement Test it was considered impractical to deal with accomplishment quotients derived from an average of two forms of the achievement test.

1. Stanford A educational age divided by the Terman A mental age.
2. Stanford A educational age divided by Terman B mental age.
3. Stanford B educational age divided by the Terman A mental age.
4. Stanford B educational age divided by the Terman B mental age.
5. Stanford A educational age divided by the average Terman A and B mental age.
6. Stanford B educational age divided by the average Terman A and B mental age.

The intercorrelations of these six accomplishment quotients gives fifteen reliability coefficients.

It is of practical importance to the Classroom teacher and the school administrator to know what confidence can be placed in an accomplishment quotient derived from a given form of an intelligence test and a given form of an achievement test. Specifically, would an accomplishment quotient derived from the Stanford A Achievement Test and the Terman A Intelligence Test be the same, or approximately the same, as an accomplishment quotient derived from the Stanford B and the Terman B? Similar questions might be raised for any pair of accomplishment quotients from the six combinations previously indicated. Rather definite answers to the above questions may be made from a detailed study of the reliability coefficients given in Table II.

TABLE II

SHOWING THE RELIABILITY COEFFICIENTS AND THEIR RESPECTIVE PROBABLE ERRORS, BASED ON TOTAL SCORES, BETWEEN VARIOUS ACCOMPLISHMENT QUOTIENTS DERIVED FROM VARIOUS COMBINATIONS OF THE STANFORD ACHIEVEMENT TESTS AND THE TERMAN GROUP TESTS OF MENTAL ABILITY

		Accomplishment Quotients				
Accomplishment Quotients		(2)	(3)	(4)	(5)	(6)
Stanford A—Terman A	(1)	.50 .05	.80 .02	.38 .06	.86 .02	.69 .03
Stanford A—Terman B	(2)		.37 .06	.72 .03	.76 .03	.59 .04
Stanford B—Terman A	(3)			.54 .05	.65 .04	.87 .02
Stanford B—Terman B	(4)				.65 .04	.86 .02
Stanford A—Ave. Ter. A and B	(5)					.74 .03
Stanford B—Ave. Ter. A and B	(6)					

Table II is to be read as follows: the reliability of the accomplishment quotients obtained from the Stanford A—Terman A and the Stanford A—

Terman B (1 with 2) is .50 ± .05; Stanford A—Terman A with Stanford B—Terman A (1 with 3), is .80 ± .02; etc., for each row of reliability coefficients.

Ruch and Stoddard[18] suggest, with hesitation, a rough way in which we might evaluate coefficients of reliability. Their suggestions follow:

Reliability Coefficient	Interpretation or Significance
0.95 to 0.99	Very high; rarely found among present tests
0.90 to 0.94	High; equaled by a few of the best tests
0.80 to 0.89	Fairly high; fairly adequate for individual measurement
0.70 to 0.79	Rather low; adequate for group measurement but not very satisfactory for individual measurement
Below 0.70	Low; entirely inadequate for individual measurement although useful for group averages and school surveys.

With the above criteria in mind let us examine the data of Table II. One is impressed with the apparently low reliability of the accomplishment quotients obtained in this study. The average of the fifteen reliability coefficients is .66 which when interpreted in accordance with the Ruch-Stoddard suggestions is entirely inadequate for individual measurement. What confidence, one may ask, can be placed in the reliability of the Stanford A—Terman A Accomplishment Quotient? Referring to row I of Table II, the range of reliability coefficients for this Accomplishment Quotient is from .38 to .86. Three of these reliability coefficients .38, .50, and .69 are low and wholly inadequate for individual measurement. The other two .80 and .86 are only fairly reliable for

TABLE III

SHOWING THE RANGE OF RELIABILITY COEFFICIENTS AND THE AVERAGE RELIABILITY OF SIX ACCOMPLISHMENT QUOTIENTS DERIVED FROM THE STANFORD ACHIEVEMENT TEST AND THE TERMAN INTELLIGENCE TEST

Accomplishment Quotients		Range of r_{12}	Average Reliability Coefficient
Stanford A—Terman A	(1)	.38 — .86	.65
Stanford A—Terman B	(2)	.37 — .76	.59
Stanford B—Terman A	(3)	.37 — .87	.65
Stanford B—Terman B	(4)	.38 — .86	.63
Stanford A—Ave. Ter. A and B	(5)	.65 — .86	.73
Stanford B—Ave. Ter. A and B	(6)	.59 — .87	.75

[18] Ruch, G. M., and Stoddard, G. D. *Tests and Measurements in High School Instruction.* (Yonkers-on-Hudson, New York: World Book Company, 1927), p. 56.

individual measurement. The average reliability of these five coefficients is but .65. Each of the remaining five accomplishment quotients may be analyzed in the same manner but the conclusion is much the same in each case. Table III summarizes the data of Table II thereby permitting comparison of the respective average reliabilities of the six accomplishment quotients.

An average reliability coefficient of .65 for the Stanford A—Terman A accomplishment quotient means that predictions of the other accomplishment quotients with which it was correlated, from it, or vice versa, would be on the average about six-tenths pure guesses.[19] Similarly, predictions from the Stanford B—Average Terman A and B, which accomplishment quotient has the highest average reliability coefficient (.75), would be about one-half pure guesses. The presence of such an amount of error is not very encouraging when we are thinking about individual diagnosis.

Reliability of the accomplishment quotients of each of the subjects in the Stanford Achievement battery was also determined. Only two subject accomplishment quotients were determined for each subject. One of these was derived by dividing the Stanford A subject age by the average of the Terman A and B mental ages; the other by dividing the Stanford B subject age by the average of the Terman A and B mental ages. Such a combination of the achievement and intelligence tests gives a more reliable accomplishment quotient than if only one form of the intelligence test were used. The mental age is thus the same in both series of quotients. The correlation between the two series of quotients provides a measure of their reliability. The results are presented in Table IV.

TABLE IV

SHOWING THE RELIABILITY COEFFICIENTS OF EACH OF THE SUBJECT ACCOMPLISHMENT QUOTIENTS OF THE STANFORD ACHIEVEMENT TEST

Subject AQ's	r_{12}
Reading A and B	.82 ± .02
Arithmetic A and B	.62 ± .04
Science A and B	.63 ± .04
Hist. and Lit. A and B	.54 ± .05
Language A and B	.39 ± .06
Spelling A and B	.88 ± .02

[19] This result is obtained by determining the coefficient of alienation, $\sqrt{1-r^2}$.

Interpreting the reliability coefficients of Table IV by the criteria of Ruch and Stoddard we may conclude:

1. The reliabilities of the accomplishment quotients in reading (.82) and in spelling (.88) are fairly high and hence, fairly adequate for individual diagnosis. It must be remembered, however, that with a reliability coefficient of .88 that prediction of one series of quotients from that of the other series would involve about 46 percent pure guesses.
2. The reliabilities of arithmetic (.62) science (.63), history and literature (.54), and language (.39) are low and entirely inadequate for individual measurement.

The data of Table IV show that the accomplishment quotients in the various subjects have different degrees of reliability. Two questions naturally arise. (1) What factors influence the reliability of the subject accomplishment quotient? In what way do these factors influence the reliability of the subject accomplishment quotient? In an attempt to find an answer to these questions, three factors seemed worthy of study: (1) The effect of the correlation between intelligence and achievement; (2) the effect of increasing the reliability of the intelligence test; (3) the effect of increasing the reliability of the achievement test.

Three series of subject accomplishment quotient reliabilities were determined for each subject as follows:

Series one = Stanford A—Terman A, SAQ[20]
with
Stanford B—Terman B, SAQ

Series two = Stanford A—Ave. Terman A and B, SAQ
with
Stanford B—Ave. Terman A and B, SAQ

Series three = Ave. Stanford A and B—Terman A, SAQ
with
Ave. Stanford A and B—Terman B, SAQ

In series one, the reliability of the intelligence test is .83, correlation of Forms A and B. The reliability of the achievement test is .93, correlation of Forms A and B. It will be observed that the reliability coefficients to be yielded in series two are the result of increasing the reliability of the intelligence test but keeping the reliability of the achievement test the same as that for series one. By combining the two forms

[20] SAQ = Subject Accomplishment Quotient.

of the intelligence test, its reliability becomes that of an intelligence test twice as long. Just what that reliability is can easily be determined by application of the Spearman-Brown formula:

$$\frac{Nr}{1+(N-1)\,r} \text{ or in our case } \frac{2r}{1+r}$$

In series two the reliability of the intelligence test is increased from .83 to .90. The reliability coefficients of series three are a result of increasing the reliability of the achievement test, but keeping the reliability of the intelligence test the same as in series one. As in the case of the intelligence test, combining the two forms of the achievement test gives a reliability of an achievement test twice as long. By application of the Spearman-Brown formula the increase in reliability of the achievement test for each subject may be determined.

Certain hypotheses may be anticipated. If increasing the reliability of the intelligence test increases the reliability of the subject accomplishment quotient, then all the reliability coefficients of series two should be larger than those of series one. If increasing the reliability of the achievement test increases the reliability of the subject accomplishment quotient, then all the reliability coefficients of series three should be larger than those of series one. Kelley[21] has said that the greater the community relation between intelligence and achievement tests (the higher the correlation between them) the lower will be the reliability of the accomplishment quotient. If this is correct, then of two achievement tests of equal reliability the one having the lower correlation with the intelligence test should yield the accomplishment quotient of higher reliability.

Table V presents data which enable us to examine these hypotheses and determine what factors affect the reliability of the subject accomplishment quotient and in what way they combine in their effect. The table is to be read as follows: column (1) gives the correlation between the Terman Intelligence Test and the Stanford Achievement Test for each subject; column (2) gives the reliability of the Stanford Achievement Test for each subject; column (3) gives the reliability of the Stanford Achievement Test for each subject when Forms A and B are combined; column (4) gives the reliability of each subject accomplishment quotient using a single form of the intelligence test and a single form of the achievement test; column (5) gives the reliability of each

[21] Kelley, T. L. *Interpretation of Educational Measurements.* (Yonkers-on-Hudson, New York: World Book Company, 1927), 299 pp.

subject accomplishment quotient using Form A of the Stanford Achievement Test and the combined Forms A and B of the Terman Intelligence Test; column (6) gives the reliability of each subject accomplishment quotient using the combined Forms A and B of the achievement test and a single form of the intelligence test.

TABLE V

SHOWING HOW THE RELIABILITY OF THE SUBJECT ACCOMPLISHMENT QUOTIENT IS AFFECTED BY THE CORRELATION BETWEEN INTELLIGENCE AND ACHIEVEMENT AND BY THE RELIABILITY OF THE INTELLIGENCE AND ACHIEVEMENT TESTS

Subjects	r_{IA}	r_{AA}	$r_{AA} = \frac{2r}{1+r}$	Rel. of SAQ when: $r_{II} = .83$ r_{AA} = Col. 2 Values	Rel. of SAQ when: $r_{II} = \frac{2r}{1+r}$ r_{AA} = Col. 2 Values	Rel. of SAQ when: $r_{II} = .83$ $r_{AA} = \frac{2r}{1+r}$
	(1)	(2)	(3)	(4)	(5)	(6)
Reading	.78	.91	.95	.69	.82	.80
Arithmetic	.52	.67	.81	.47	.62	.78
Science	.69	.78	.88	.57	.63	.80
Hist. and Lit.	.70	.79	.87	.50	.54	.79
Language	.53	.60	.75	.30	.39	.86
Spelling	.52	.91	.95	.72	.88	.82

r_{II} = reliability of the intelligence test.
r_{IA} = correlation between intelligence and achievement.
r_{AA} = reliability of the achievement test.
$\frac{2r}{1+r}$ = Spearman-Brown formula for determining reliability when length of test is twice as long.
SAQ = subject accomplishment quotient.

An examination of the data of Table V relative to the hypotheses raised reveals the following facts:

1. Increasing the reliability of the intelligence test increases the reliability of the subject accomplishment quotient. Each of the reliability coefficients of column (5), series two, is higher than its corresponding reliability coefficient of column (4), series one.
2. Increasing the reliability of the achievement test increases the reliability of the subject accomplishment quotient. Each of the reliability coefficients of column (6), series three, is higher than its corresponding reliability coefficient of column (4), series one.
3. The reliability coefficients of reading and spelling, column (6) are lower than the corresponding reliability coefficients of column (5). For arithmetic, science, history-literature, and language, the reliability coefficients of column (6) are higher than the corresponding reliability coefficients of column (5). These differences may be accounted for by the fact that the achievement tests in reading and spelling have high reliability, .91 and .91 respectively, when only one form of the achievement test is used. Doubling the length

of the achievement test in these subjects adds only 4 points to their reliabilities, while doubling the length of the intelligence test adds 7 points to its reliability. For arithmetic, science, history-literature, and language doubling the length of the achievement test in these subjects increases the reliability in each instance by a greater amount than is the increase which accompanies doubling the length of the intelligence test. These facts suggest that the test, intelligence or achievement, whose reliability is most increased has the greatest effect on the reliability of the subject accomplishment quotient.

4. It will be observed from column (2) of Table V that the reading and spelling achievement tests have the same reliability, .91 and .91 respectively. Reading correlates with intelligence .78; spelling correlates with intelligence .52. A comparison of the accomplishment quotient reliabilities, column (5), for these two subjects shows that spelling with the lower correlation with intelligence has the higher accomplishment quotient reliability. The achievement tests in science and history-literature have practically the same reliability, .78 and .79 respectively (column 2), but science, which has the lower correlation with intelligence, has the higher accomplishment quotient reliability (column 5). These facts suggest that the reliability of the accomplishment quotient is increased as the correlation between intelligence and achievement is decreased. It is probably worthy of note that in case of science and history-literature, though the difference in the correlation between intelligence and each test is small (1 point), such difference is accompanied by 9 points difference in the reliability of the respective subject accomplishment quotients. In the case of reading and spelling, the difference in correlation with intelligence is 26 points which is accompanied by a difference of only 6 points in subject accomplishment quotient reliability. The explanation of this apparent inconsistency seems to be that the higher the reliability of the intelligence and achievement tests, the less the influence of the correlation between intelligence and achievement. Herring[22] has shown empirically for accomplishment differences that with intelligence tests and achievement tests of very high reliability (.97 or .98) the correlation between intelligence and

[22] Herring, J. P. "The Reliability of Accomplishment Differences," *Journal of Educational Psychology*, XV (November, 1924), pp. 530-538.

achievement matters little. The reading test with a reliability of .91, the spelling test with a reliability of .91, and the intelligence test with a reliability of .90 are approaching high reliability, and hence, the correlation between intelligence and achievement would matter less. The science test and the history-literature test, however, with reliabilities of .78 and .79 respectively, are low in reliability, and therefore, we should expect greater influence of the correlation between intelligence and achievement.

GENERAL SUMMARY

This study has been concerned with an attempt to secure data on the reliability of the accomplishment quotient. The subjects used were a group of beginning junior high-school students. The tests used to derive the accomplishment quotient were: the Stanford Achievement Test, Forms A and B, and the Terman Group Tests of Mental Ability, Forms A and B. Various combinations of the achievement and intelligence tests yielded six accomplishment quotients for each student. The achievement age used in determining each of the six accomplishment quotients was based on the total score of either Form A or B of the Stanford Achievement Test. Accomplishment quotients in reading, arithmetic, science, history and literature, language, and spelling were determined by dividing achievement ages in these subjects by the average of the Terman A and B mental ages. The correlation between parallel series of accomplishment quotients was used as a measure of their reliability. Three factors were studied in terms of their influence on the reliability of the accomplishment quotient. These factors were: the reliability of the intelligence test; the reliability of the achievement test; the correlation between the intelligence and the achievement test. The data of the study permit the following conclusions:

1. The average reliability of six accomplishment quotients derived from various combinations of the Terman Group Test of Mental Ability and the Stanford Achievement Test is only .66. Such a reliability coefficient suggests that the accomplishment quotient derived from these tests is entirely inadequate for individual diagnosis.
2. The subject accomplishment quotients in reading and spelling were found to be only fairly adequate for individual measurement. The arithmetic, science, history and literature, and language accomplishment quotients as derived from these tests are entirely unreliable for individual diagnosis.

3. Three factors seem to have decided influence on the reliability of the accomplishment quotient: the reliability of the intelligence test, the reliability of the achievement test, and the correlation between the intelligence and the achievement tests. These three factors appear to affect the reliability of the accomplishment quotient in the following manner: increasing the reliability of the intelligence test increases the reliability of the accomplishment quotient; increasing the reliability of the achievement test increases the reliability of accomplishment quotient; decreasing the correlation between the intelligence and achievement tests increases the reliability of the accomplishment quotient. The converse of these latter statements also holds. With intelligence and achievement tests of high reliability, the correlation between intelligence and achievement tests is of minor concern.

Conclusions 1 and 2 above do not necessarily mean that we should discard the accomplishment quotient as an index of achievement in terms of capacity to achieve. Rather perhaps, it should be retained but should be used cautiously, if at all, in the field of individual diagnosis until such time as there are much more reliable intelligence and achievement tests than now exist.

SHORTER ARTICLES

INSTRUCTORS' USE OF MENTAL TEST SCORES

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ADMINISTRATIVE policy in regard to the educational utilization of mental test scores depends in part upon the correct answer to this question: "Will the scholastic grades given by instructors be influenced by knowledge of students' scores on a previous test of mental ability?" A small amount of experimental data on this problem is here reported.

Freshman and sophomore survey courses at the University of Oregon are sectioned and divided among several instructors. Three instructors taught sections in the particular course under consideration in the fall terms of both 1928-29 and 1929-30. In 1928-29 they did not know the standing of their students on the University's entrance mental test (the American Council on Education Psychological Examination), but in 1929-30 these scores were entered on their class roll cards at the first of the term. The specific problem then was whether the correlation between students' mental test score and the grade received in this course was higher in 1929-30 than in 1928-29—higher with knowledge than without knowledge of the students' mental classification. In other words, if instructors are informed of their students' mental test scores, will a "halo effect" carry over into their grades?

Data for the entire enrollment of the sections taught by these three

TABLE I

CORRELATION BETWEEN MENTAL TEST SCORE AND GRADE IN SURVEY COURSE, FOR ENTIRE ENROLLMENT OF THREE INSTRUCTORS

Instructor	Year	Number of Cases	Correlation between Test Score and Grade	Chances that Difference in Correlations Is Significant
A	1928-29	169	.367 ± .045	990 to 10
	1929-30	81	.595 ± .048	
B	1928-29	73	.390 ± .067	519 to 481
	1929-30	119	.384 ± .053	
C	1928-29	78	.573 ± .051	691 to 309
	1929-30	54	.510 ± .068	
All Three	1928-29	320	.428 ± .031	865 to 135
	1929-30	254	.501 ± .032	

instructors are shown in Table I; instructor A had two sections of this course and instructors B and C had one section each. Obviously A's students received grades more in accordance with their mental test scores when A knew what those scores were than when he did not. This difference, statistically, is highly significant. The tendency for B and C is in the opposite direction, but not significantly so.

To meet the possible objection that differences in level of class ability, though slight, might account for discrepancies in correlation coefficients, pairing of individuals was utilized to select equally able class groups for 1928-29 and 1929-30. For each instructor, individual students were paired as to mental test score and sex, by random sampling in alphabetical order. This limited measurable differences in the experiment to the grades received in this particular survey course, the crucial step in any controlled experimentation. As shown in Table II, the resulting correlation coefficients are very similar to those derived from the entire, unpaired sections.

TABLE II

CORRELATION BETWEEN MENTAL TEST SCORE AND GRADE IN SURVEY COURSE, FOR GROUPS IN SUCCESSIVE YEARS PAIRED AS TO TEST SCORE, SEX, INSTRUCTOR

Instructor	Year	Number of Cases	Correlation between Test Score and Grade	Chances that Difference in Correlations Is Significant
A	1928-29	80	.488 ± .057	901 to 99
	1929-30		.611 ± .047	
B	1928-29	71	.357 ± .070	677 to 323
	1929-30		.422 ± .066	
C	1928-29	37	.509 ± .082	606 to 394
	1929-30		.464 ± .087	
All Three	1928-29	188	.431 ± .040	896 to 104
	1929-30		.522 ± .036	

Kelley's formulas 139 to 129 (*Statistical Method*, 1923) were used in determining the chances for significant differences in Table II, to allow for a correlation forced by the pairing of individuals; in Table I his formula 140 applied.

Although it is conceivable that with knowledge of test scores our instructor A adapted his methods and requirements to the variously able individuals, the probability seems strong that his judgment of scholastic achievement, rather, underwent adaptation. We think these data can be taken at practically face value.

NOTES ON THE RELIABILITY OF DEARBORN GENERAL EXAMINATION C

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THE cases for this study were chosen at random from records on file at the Harvard Psycho-Educational Clinic. These records had been obtained partly from the testing of a large junior high school in a city near Cambridge, Massachusetts, and partly from tests given in a survey of a Pennsylvania city conducted by the staff of the Harvard Graduate School of Education. The test papers were arranged alphabetically, and individual cases were then selected until there were at hand more than 100 cases for each grade from the sixth to the ninth, inclusive.

The reliability coefficients were computed by the Spearman-Brown technique, using the odd and even items as the two variables. The probable errors of measurement were calculated from the formula $.6745\ \sigma\sqrt{1 - r_{12}}$.

The results of this study are set forth in two tables, the first showing the reliability measures for the several grades, and the second presenting the reliabilities for the various ages. In connection with the second table it should be noted that selected groups of the 11-, 15-, and 16-year olds were used, because the cases included no children below the sixth grade and none above the ninth. Thus the results for these ages are not entirely dependable, although there is strong evidence that they are approximately correct, since they agree rather closely with one another and with the findings for the other ages.

TABLE I

RELIABILITY OF DEARBORN GENERAL EXAMINATION C IN GRADES VI TO IX

Grade	N	Standard Deviation	Reliability Raw	Coefficients Corrected	P.E. of Measurement
VI	129	10.96	.849	.918	2.13
VII	209	10.88	.803	.898	2.35
VIII	117	10.50	.719	.840	2.87
IX	110	10.80	.785	.880	2.52
All grades	565	12.33	.838	.912	2.47

TABLE II

RELIABILITY OF DEARBORN GENERAL EXAMINATION C FOR AGES ELEVEN TO SIXTEEN

Age	N	Standard Deviation	Reliability Raw	Coefficients Corrected	P.E. of Measurement
11	53	12.76	.865	.927	2.27
12	115	12.24	.852	.921	2.00
13	134	11.57	.765	.866	2.86
14	132	13.01	.837	.912	2.60
15	73	11.76	.772	.871	2.85
16	29	12.41	.814	.897	2.68

The standard deviations and probable errors of measurement shown in the tables are in terms of raw score points. Sheppard's correction for grouping has been applied to all standard deviations.

An examination of the tables will reveal that the reliability coefficient of Dearborn Examination C is about .90 for the ages and grades considered. This is high for single age and grade groups. The average probable error of measurement is about 2.5 score points. This means a probable error of about five months in the mental ages derived from the raw scores, and a probable error of three or four points in the intelligence quotients.

EDITORIALS

COÖRDINATION OF EDUCATIONAL RESEARCH

WHEN the educational history of the first half of the twentieth century is written, the third decade of this period will be credited with the initiation of a program of coördination or coöperation in educational research. This statement should be substantiated by reference to specific studies together with dates of publication of the results secured.

The curriculum field includes the Reorganization of Mathematics in Secondary Education (1923), the Classical Investigation (1924-25), and the Modern Foreign Language Study (seventeen volumes, 1927-31). Other completed investigations of large scope include the Character Education Inquiry (three volumes, 1928-30), studies promoted and subsidized by the Committee on Administrative Units of the Commonwealth Fund (eleven published volumes, 1922-29), six investigations of adult education sponsored by the Carnegie Corporation (1926-28), the Educational Finance Inquiry (thirteen volumes, 1923-24), the Stanford Genetic Studies of Genius (three volumes, 1925-30), the Chicago studies of reading and arithmetic, and the National Survey of Land Grant Colleges made by the Office of Education. Nation-wide coöperative studies yet under way include the three surveys by the Office of Education (Secondary Education, Teacher Education, and School Finance), the investigation of the social studies by the American Historical Association, the National study of English usage sponsored by the Psychological Corporation, and the White House Conference on Child Welfare.

Illustrations of this method of promoting and organizing educational research are found in the work of the great foundations (Carnegie Foundation for the Advancement of Teaching, Commonwealth Fund, and General Education Board), and of professional groups and associations both general and subject-matter (National Society for the Study of Education, Department of Superintendence, American Historical Association, and National Federation of Modern Language Teachers). The United States Office of Education, Research Division of the National Education Association, and city, state, and university bureaus of research have been active in the coördination of research in the areas represented.

The type of bibliographical and summary work done by Gray in reading, Buswell and Judd in arithmetic, Lyman in language, grammar, and composition, and Curtis in science, as well as the contribution of such journals as *Psychological Abstracts, Psychological Bulletin, Social Science Abstracts, Teachers Journal and Abstract,* and *Review of Educational Research* may be viewed as an aid in the unification of investigational effort. Publication by universities of series of individual studies (*Teachers College Contributions to Education* and the Chicago *Supplementary Educational Monographs*) or of volumes of graduate abstracts serves the same purpose.

This type of coördinated investigation and publication should break down excessive academic isolation in research, prevent wasteful and unnecessary duplication of effort, and make readily available and applicable the results of major scientific studies to field workers.

It seems entirely reasonable to expect within the next decade in each of the subject-matter fields a survey similar in scope to the Modern Foreign Language Study and a summary of the available factual studies similar in comprehensiveness to that of Gray in reading. Whatever the future may hold, however, in the development of coördinated large-scale research, there is encouragement for the present in the progress here reported. The obligation of the field worker is to keep informed concerning important studies in progress, to coöperate wherever possible, and to use the findings reported in the improvement of teaching, curricular, or administrative procedures.

CARTER V. GOOD

REVIEWS

Address all communications relative to book reviews to Editor E. J. Ashbaugh, Miami University, Oxford, Ohio.

BONSER, FREDERICK G. *Industrial Arts.* New York: Teachers College, Columbia University, 1930. vi + 95 pp.

Professor Bonser defines industrial arts as a school subject as: "A Study of the changes man makes in materials to increase their values to meet needs, of the appropriate usage of products made, and of the social advantages and problems resulting from the making of these changes and products." This conception places industrial arts, in educational content with the humanities and the sciences. The disciplinary values of "manual training," "manual arts," and "handwork," getting their content, as well as aim, from psychology, have been replaced by "industrial arts" with social values, receiving its content from sociology.

With such a concept of industrial arts, school officials are no longer recognizing this school subject as a "fad" or a "frill," but giving it merited consideration with other school subjects. "As a field not so well established as the older school subjects," Dr. Bonser says, "industrial arts presents many problems to the superintendent of schools."

In concise but clear language the author sets forth the same principles as expressed in earlier works, such as *The Elementary School Curriculum* by F. G. Bonser, and *Industrial Arts for Elementary Schools* by F. G. Bonser and L. C. Mossman. Details of content and method in connection with the elementary period of schooling are given in all too brief form. But the junior and senior high-school periods receive more consideration, especially in details of organization, than in the earlier works.

The field of industrial arts is so broad and its purposes, methods and organization are so varied in the different periods of schooling, that it would seem that the author might well have increased somewhat the size of his present work, even for the consideration of the busy school superintendent.

Professor Bonser, in his present treatment of industrial arts, has put in a concise form material which might profitably form the basis for one unit in the preparation of the school administrator. Even the younger administrators have been educated under a school system which has emphasized verbal and abstract experiences to the exclusion of concrete experiences. Dr. Bonser nicely expresses this idea in his statement "well developed work in the industrial arts and closely related subjects would give *all* pupils an opportunity for growth equal to that now afforded to the brightest only."

F. C. WHITCOMB
Miami University.

HARTLEY, HELENE W. *Tests of the Interpretative Reading of Poetry for Teachers of English.* New York: Columbia University, 1930. v + 47 pp.

Dr. Hartley's study purposes to develop and, somewhat, to standardize

objective tests of the intellectual comprehension of poetry. The two avowed functions and uses of the tests are, first, to determine the perceptive capacities of prospective teachers of English so far as poetry is concerned, and, second, to aid in the development of these perceptive capacities both of teachers in training and of students of poetry in general.

The construction of the tests is founded upon the entirely sound assumption that the development of appreciation is in large part based upon the ability to comprehend meaning. "Meaning," however, is not to be understood narrowly. It concerns not only idea, but also mood, fact, image, and experience.

It follows, therefore, that the tests must scrutinize the reader's relation to poetry in at least four particulars. 1. Does the reader perceive "meanings conveyed by figures and symbols"? 2. Does he perceive "meanings conveyed through sense impressions"? 3. Does he perceive "meanings conveyed by suggestion or implication as of word values or rhythm"? 4. Does he perceive "literal" meaning when it is "typically condensed or structurally irregular"? The test, in short, proposes to discover whether the reader perceives "complete meaning," and whether he is sensitive to the several media poetry employs to achieve its ends.

The form of the tests is discussed briefly, as is the experimental method employed in their development. Correlations with other literature tests of similar or dissimilar nature are tabulated. Forms A and B of the tests are included in the appendix of the study. The tests may be roughly (but not inaccurately) described as comprehension tests of the multiple-choice response type.

This reviewer readily acknowledges the soundness of most of the hypotheses of the study and the fitness of the techniques employed. His questions, as he considers the whole study, however, are these: Just how much more do we know about the prospective teacher as a result of his success or failure in the tests than we should have been able to discover from almost any of the other general intelligence tests? Might not either success or failure with the tests often lead the examiner to prognosticate most erroneously as to the candidate's probable skill as a high-school teacher?

HOWARD F. SEELEY
Ohio State University.

EZEKIEL, MORDECAI. *Methods of Correlation Analysis.* New York: John Wiley & Sons, Inc., 1930. xiv + 427 pp.

The field of statistics has sometimes been divided into the statistics of averages, the statistics of variation, and the statistics of relationship. The classification leaves something to be desired because it ignores some topics and because no one of these divisions can be adequately considered without calling upon the other two. Neverthless the classification is significant as an indication of emphasis.

The book by Dr. Ezekiel is a treatment of the statistics of relationship. It bestows no more attention upon averages and measures of variation than the development of its special theme requires. Of all measures of central tendency it uses only the mean; and although in an early chapter the average deviation is illustrated, the only measure of variation which is really employed is the standard deviation.

This is as it should be. The problem of the book is to portray the methods of establishing statistical relationships; and since these methods require no mean but the arithmetic mean and no measure of variation but the standard deviation,

the treatment of other means and other measures of variation would be a digression.

Within the field chosen, the reviewer knows not where to go for so full and so sensible a treatment of the subject. Not only will the student find simple, partial and multiple correlation depending upon straight line relationships, together with the usual regressions and errors of estimate; but he will also find a detailed presentation of the same concepts based on curvilinear functions. There is much, also, about curve fitting, but the mathematics of this branch of the subject is rather disappointing. Either the author's choice of data was unfavorable or the occasions when parabolas and logarithmic and reciprocal curves will afford a satisfactory "fit" are conspicuously few in number. A well-drawn free-hand curve was generally found to be superior.

Although most of the problems and illustrations are drawn from agriculture—and especially from agricultural economics—the student of psychology or education will have no difficulty in transferring the methods in his chosen field.

In connection with linear relationships, the author has a preference for using r^2 instead of r as a measure of relationship. He calls r^2 the coefficient of determination. He points out the fact that each cofficient of correlation has its corresponding coefficient of alienation, and that since the sum of these is greater than unity, neither of them can be taken as a percent. He points out the simplicity and usability of a constant which enables us to say "this measures the percent to which the variance in Y is determined by X."

The author's lucid statement of the meaning of the various measures with which he deals is in refreshing contrast to the arid wastes with which most books on statistics abound. He is aided in this by the fact that all his technical discussions are based on actual problems. But this is not all. After he has carried the reader through a detailed procedure, he stops and surveys its significance. For example, after dealing with two variables both in rectilinear and curvilinear relationship, he gives us a short chapter in which he says in substance: "Now, you may find this confusing, but remember that so far as linear correlation is concerned three constants tell practically the whole story. They are, first, the coefficient of regression, which enables you to estimate the value of one variable from that of another; second, the standard error of estimate, which tells you how true that estimate is; and, third, the coefficient of determination (r^2) which tells the proportion of the variance in one variable which can be explained by or estimated from the variance of the other —the importance of the relation between the two variables."

So far as the reviewer is aware, certain topics in the treatment of the relationship of three or more variables are original. This is particularly true of parts of the chapters on curvilinear multiple correlations; *e. g.*, the development of approximate methods, the discussion of non-quantitative factors as they affect the dependent variable, and the recognition of joint variation.

Here and there throughout the book and especially in the final chapter, the author warns the statistical worker not to expect his figures to serve purposes which they are not intended to serve. "The correlation analysis itself," he says, "can never provide the interpretation as to cause and effect. It can only establish the *facts* of the relations—for the meaning of those facts the investigator must look elsewhere." Again and even more pertinently he concludes: "Ex-

cept insofar as the effort to reduce the variables to specific numerical statement, definitely related, forces the investigator to think more clearly and definitely about his problem, statistical analysis is not a substitute for logical analysis, clear-cut thinking, and full knowledge of a problem."

An excellent book, competently written, and wholesome in its point of view.

B. R. BUCKINGHAM

Harvard University.

LAMSON, E. D. *Study of Young Gifted Children in Senior High School.* New York: Teachers College Contributions to Education, 1930, No. 424. viii + 117 pp.

This monograph, after a brief review of the literature on gifted children of high-school ages, presents data on 56 gifted high-school pupils checked against control groups. These 56 pupils included 19 girls and 37 boys whose modal year of high school entrance was 1925. By a random sampling process, 106 out of 961 pupils entering the same schools in 1925 were selected as the *control group of entrants.* In addition a *control group of survivors* numbering 110 pupils (a pair for each of 55 gifted children) was selected from those still "on register" at the time of the study of the gifted pupils. Gifted and control pairs (survivors) were equated for age, sex, grade, and school attended.

The reviewer commends the care with which this study was planned; the only principal criticism which might be raised is the relatively small number of gifted pupils. (It should be noted that in many of the comparisons the 56 gifted pupils were still further reduced by incomplete returns on certain items).

The comparisons made covered, principally: constancy of intellectual status, school achievement and failures, participation and interest in extra-curricular activities, health, teachers' judgments, and future plans and attitudes.

Certain of the major findings follow:

1. The gifted group for three successive years maintained its status in the top centile of intelligence. Of the adolescents of the group over fifty percent reached the top centile of adult Army Alpha scores.

2. The gifted group measured from 5 to 9 points higher than the controls on the Regents' examinations and in their high-school marks.

3. Gifted earned scholarship honors four to nine times more often than the controls.

4. A questionnaire on participation in extra-curricular activities showed 4.4 activities for each participating gifted child and 3.5 activities when all 56 were considered.

5. On a rating scale (similar to that used by Terman in *Genetic Studies of Genius,* Vol. 1) the teachers scored gifted significantly higher than control pupils on such traits as intelligence, quality of school work, and effort.

6. Of the gifted group, 87.5 percent expect to go to college and most of these have decided upon a particular college.

7. No evidence was found that early entrance to high school had impaired health.

8. Three-fourths of the gifted pupils were glad that they had attended opportunity classes affording enriched programs and rapid progress.

The Appendix gives considerable detailed information which is in the nature of case studies.

G. M. RUCH

University of California.

RESEARCH ABSTRACTS and BIBLIOGRAPHIES

Address all communications relative to research abstracts and bibliographies to Editor A. S. Barr, University of Wisconsin, Madison, Wisconsin.

BULLETINS

BREED, FREDERICK S., AND OTHERS. "Special Methods in the Elementary Schools," *Review of Educational Research*, I (October, 1931), 245-323.

This issue of the *Review of Educational Research* is devoted to a summary of investigations relating to special methods in the elementary school.

CALDWELL, O. W. "The Work of the Institute of School Experimentation," A Reprint from *Teachers College Record*, XXXIII, No. 2 (November, 1931).

Setting forth the aims and purposes of the institute with a report of projects completed or in progress.

Character Building: Elementary School Procedures. Kansas City School Service Bulletin, Series No. 2, IV, Kansas City Public Schools, Mo. (November, 1931), 121 pp.

Contains a wealth of materials for the use of elementary school teachers in the teaching of character education.

ODELL, C. W. "Provisions for Mentally Atypical Pupils," University of Illinois Bulletin, XXIX, No. 6. (September 18, 1931), 73 pp.

Contains a statement of the problem and chapters on homogeneous groupings, special rooms and teachers, miscellaneous provisions, general programs to provide for children of atypical mentality, and a brief consideration of objections to provisions for children of atypical mentality.

DOUGLASS, H. R. "The Relation of High School Preparation and Certain Other Factors to Academic Success at the University of Oregon," III, No. 1. University of Oregon Publication (September 1931), 61 pp.

Contains a statement of the problem, the sources of data, correlations as measures of association, high-school marks and scholastic achievement in college, the pattern of the high-school course and scholastic achievement in college, the principal's ratings on stability, industry, leadership and citizenship, schools from which students graduated and college marks, multiple correlation coefficient and regression equations, summary, interpretation and implication. Bibliography.

NOBLE, EMILY HARRIS. "Status and Professional Preparation of Recreation Center Executives and Workers in California, 1929," *University of California Publications in Education*, VI, No. 4. Berkeley, California, 1931. 66 pp.

Contains data on the number, professional standards, condition of employment, and nature of work for recreation workers in California, the curriculum in recreation offered in universities, colleges and other schools in the United States and Canada with special consideration of courses available in California. General conclusions.

PREWETT, HATTIE O., DIRECTOR. *The Economic Advantage of Special Promotions:* The Amount Saved to the School System by Permitting Pupils to Skip Half-Grades. Public Schools, Fort Worth, Texas, 1931. 27 pp.

The author presents an analysis of special promotions in the Fort Worth, Texas, schools from September 1920 to June, 1930.

The Unit Method as a Means for Individualizing Learning Activities, University of Virginia Record Extension Series, XVI, No. 5 (November, 1931), 54 pp.

This bulletin presents a series of eight papers relating to the unit method as individualizing learning activities.

EDUCATIONAL ADMINISTRATION AND SUPERVISION

BRECKINRIDGE, ELIZABETH. "A Study of the Relation of Preparatory School Records and Intelligence Test Scores to Teaching Success," *Educational Administration and Supervision,* XVII (December, 1931), 649-670.

The author finds that high-school records and intelligence tests score have little predictive value as far as teaching success is concerned.

CAREY, RAYMOND B. "The Administration of the Finances of Extra-Curricular Activities," *Educational Research Record,* IV, No. 1, University of Nebraska Publications (October, 1931), 5-12.

The author presents a survey of the literature dealing with financial management of extra-curricular activities, and the result of a five year experiment in a centralized plan of handling extra-curricular funds.

CERTAIN, C. C. "An Empirical Basis for Scientific Standards in School Libraries," *Junior-Senior High School Clearing House,* VI (December, 1931), 206-215.

The author reviews the various steps taken in the development of school library standards, and presents a new score card.

CUNNINGHAM, MARGARET S. "An Experiment in Class Size in B9 Algebra," *California Quarterly of Secondary Education,* VII (October, 1931), 19-28.

A group of 100 pupils was divided into two classes of equal ability, one class being double in size of the other. Higher median and mean scores were found for the large group in four quarterly tests.

DIX, LESTER. "Judging the Junior High School," *Educational Administration and Supervision,* XVII (December, 1931), 641-648.

The author presents criteria for judging success of junior high schools.

ELIASSEN, R. H., AND ANDERSON, EARL W. "Investigations of Teacher Supply and Demand Reported since November, 1930," *Educational Research Bulletin,* X, No. 18, Ohio State University (December 9, 1931), 479-483.

A summary of investigations of teacher supply and demand reported since November, 1930.

MATZEN, JOHN MATHIASON. "Codification of Expenditures for School Supplies," *Educational Research Record,* IV, No. 1, University of Nebraska Publication, (October, 1931), 1-4.

The author presents an analysis of the system of codifying expenditure for school supplies in the state of Nebraska.

NEWLUN, CHESTER. "The Selection of Basal Readers," *The Elementary School Journal*, XXXII (December, 1931), 285-293.

The author presents a set of criteria for the selection of readers based upon expert opinion.

SMUTZ, L. S. "The Administration of Awards for Non-Physical Education Activities in High School," *Educational Research Record*, IV, No. 1, University of Nebraska Publications (October, 1931), 16-19, 22-27.

The author presents analysis of the administration of awards for non-physical education activities in high schools. The history of the practice of granting awards, the attitude of common educators for the granting of awards, administrative procedures, etc.

VALENTINER, DR. TH. "*Erfahrungen bei der Sextanerauslese in Bremen* (The Findings of the Secondary School Selection Process in Bremen)," *Zeitschrift für Angewandte Psychologie*, XXXIX (June, 1931), 123-166.

A description of the technique of testing, promoting, and eliminating. Due to the increasing competition, class marks in the first year of the secondary school are lower than those obtained by the same pupils in the last elementary grade.

(E. Appelt, University of Wisconsin)

VAN DYKE, GEORGE E. "Trends in the Development of the High-School Offering. II," *School Review*, XXXIX (December, 1931), 737-747.

The second of a series of articles discussing trends in the development of high-school offerings. Presents an analysis of a number of courses offered within the various subject groups. Programs of study to-day show less standardization than they did fifteen or twenty years ago.

EXPERIMENTAL STUDIES OF LEARNING AND TEACHING

BUSEMAN, ADOLF, UND BAHR, GERDA. *Arbeitslosigkeit und Schulleistung* (Unemployment of the Father and Achievement of the Child)," *Zeitschrift für pädagogische Psychologie*, IX (1931), 417-421.

Unemployment of the father lowers the grade of achievement of the good pupil more than that of the average pupil. (E. Appelt, University of Wisconsin)

CEDERSTROM, J. A. "Repeaters at the College Level," *Journal of Applied Psychology*, XV (August, 1931), 411-417.

The author uses an achievement scale in college zoology, Forms A and B, to measure the initial status and final status of repeaters at the college level. While these repeaters start with a higher initial score, this lead is gradually reduced as the course progresses. There is little difference between the mean scores of repeaters and regular students at the end of the course.

COURTIS, S. A. "La Courbe de Croissance et la Determination Inductive des Elements Psychologiques," (The Curve of Growth and the Inductive Determination of Psychological Elements), *Archives de Psychologie*, (Archives of Psychology) XXIII, No. 90 (October, 1931), 167-178.

The author presents data on the Curve of Growth with a mathematical equation for the Ideal Curve.

CROSLAND, H. R. "Letter-Position Effects, in the Range of Attention Ex-

periments, as Affected by the Number of Letters in Each Exposure," *Journal of Experimental Psychology*, XIV (October, 1931), 477-507.

The author finds that there is a rapid decline according to letter-position from left to right, with a descending effectiveness up to the sixth letter-position, after which there is no further decline.

GATTO, FRANK M. "The Experimental Trial of Certain Practice Lessons in Silent Reading of the Study Type," *Bulletin, Pittsburgh Schools*, VI, No. 2, Board of Public Education (November, 1931), 92-103.

An experimental study from which the author concludes that groups using specially devised practice lessons made greater gain than groups not using such material.

GATTO, FRANK M. "An Experiment to Evaluate the Effectiveness of Two Reading Systems in the First Grade," *Bulletin, Pittsburgh Schools*, VI, No. 2, Board of Public Education (November, 1931), 72-92.

The author presents data relative to an equivalent grouping experiment in first grade reading. A work book system of individual instruction appears superior.

HURD, A. W. "The Textbook versus Work Sheets in Instruction," *Educational Administration and Supervision*, XVII (December, 1931), 661-664.

The author compares the textbook and work sheet method of instruction. In some schools the differences clearly favor the work plan, in others the textbook plan. On the whole the margin is in favor of the work sheet plan.

KARWOSKI, THEODORE. "The Memory Value of Size," *Journal of Experimental Psychology*, XIV (October, 1931), 539-554.

An experimental study from which the author concludes that size has a memory value in proportion as it has attention value.

LUITHLEN, WILHELM F. "*Zur Psychologie der Initiative und der Führereigenschaften* (The Psychology of Initiative and the Quality of Leaders)," *Zeitschrift für Angewandte Psychologie*, XXXIX (June, 1931), 56-122.

On the basis of theoretical considerations the author concludes that an ideal leader has to possess initiative, ambition, and vitality. After having described a number of tests given by him, the author states that the two-person method of measuring character traits is the best way of selecting leaders. (E. Appelt, University of Wisconsin)

LYMAN, R. L. "A Co-operative Experiment in Junior High School Composition," *School Review*, XXXIX (December, 1931), 748-757.

The experiment herein reported was conducted by thirty-one teachers working with one thousand thirty-nine pupils of grades six, seven, eight and nine in twenty junior high schools and eleven elementary schools in Chicago and vicinity, during seven successive weeks of March and April, 1931. The coöperators felt that their pupils grew materially in language consciousness, showed satisfactory gains in avoiding minor errors, grew accustomed to preliminary plannings, and manifested some growth in the quality of their compositions.

LYMAN, R. L. "Summary of Investigations Relating to Grammar, Language, and Composition (January, 1929, to January, 1931). I," *The Elementary*

School Journal, XXXII (December, 1931), 266-275.

An annotated summary of investigation relating to grammar, language and composition from January, 1929, to January, 1931.

McCARTY, PEARL SANDS. "Increasing Comprehension in Silent Reading," *School Review*, XXXIX (December, 1931), 758-766.

Two groups of pupils from grades nine and ten in the West Virginia University high school served as subjects for this study. One group received special training in reading; the other received no training. The result of the experiment show that remedial instruction gave a greater, though not a statistically significant, increase in comprehension.

McGEOCH, JOHN A., AND McDONALD, WILLIAM T. "Meaningful Relation and Retroactive Inhibition," *American Journal of Psychology*, XLIII (October, 1931), 579-588.

A study of the relationship which exists between the degree of retention of memorized material and the kind or amount of activity interpolated between memorization and the measurement of the amount of retention. The learning of interpolated lists of adjectives grouped in three divisions with respect to their degree of synonymy to the original lists yields amounts of retroactive inhibition which vary directly as the degree of synonymy. These results are interpreted in favor of a transfer theory of retroactive inhibition.

McTEER, WILSON. "A Study of Certain Features of Punishment in Serial Learning," *Journal of Experimental Psychology*, XIV (October, 1931), 453-476.

After summarizing related investigations the author presents an experimental study of punishment in serial learning, from which he concludes that an electric shock of the intensity here used resulted in a more cautious attitude on the part of the learners. The punished learners learned the combinations with fewer trials and fewer errors than non-punished learners, though the time required was the same for both groups.

SCHMIDBERGER, GUSTAV. "*Uber Schulfleiss und Schulaufmerksamkeit bei Knaben und Mädchen* (Diligence and Classroom Attention of Boys and Girls)," *Zeitschrift für pädagogische Psychologie*, IX (1931), 392-397.

Girls are superior to boys at all levels. Diligence decreases with increasing age. But girls' diligence marks decrease more slowly than boys' marks. The difference between achievement of boys and girls increases with age. Classroom attention of girls is better than that of boys, but the difference is not so great as in the case of diligence. (E. Appelt, University of Wisconsin)

SEASHORE, SIGFRID. "The Aptitude Hypothesis in Motor Skills," *Journal of Experimental Psychology*, XIV (October, 1931), 555-561.

After summarizing previous investigations the author presents a correlation study of motor skills, from which he concludes that, considering the high reliability of both the test and the criterion, the non-significant correlations found in the investigation may be taken as definite evidence against the hypothesis of a group of basic motor skills as determinants of practical machine skills, and as pointing toward a theory of highly specific motor skills.

STEVENSON, ELMO N. "Children's Nature Interests," *The Elementary School Journal*, XXXII (December, 1931), 276-284.

The author presents a summary of previous investigations relating to children's nature interests and the result of an investigation carried on in the demonstration school of the San Jose State Teachers College, San Jose, California. The results in general corroborate the results of former experiments. The author formulates the following principles: (1) that children are interested in nature objects; (2) that live animals are most interesting; (3) that the unusual, unique and spectacular things grip the interest of children; and (4) that children's interests vary from time to time.

CURRICULUM CONSTRUCTION

CARPENTER, W. W. "Curricular Offerings in Missouri," *Junior College Journal*, II (October, 1931), 16-23.

A comparison of the curricular offerings of the junior colleges in Missouri with those of junior colleges in other parts of the country.

DALE, EDGAR. "A Comparison of Two Word Lists," *Educational Research Bulletin*, X, No. 18, Ohio State University (December 9, 1931), 484-489.

A comparison of the International Kindergarten Word List with the Thorndike Word List.

DALE, EDGAR. "Evaluating Thorndike's Word List," *Educational Research Bulletin*, X, No. 17, Ohio State University (November, 1931), 451-457.

The author presents a critical review of Thorndike's Teacher's Word Book, published in 1931.

LINDAHL, HANNAH M. "History in the Intermediate Grades," *The Elementary School Journal*, XXXII (December, 1931), 257-265.

The author presents a discussion of recent trends in the teaching of history in intermediate grades based upon the examination of fifty-seven courses of study. He presents a number of conclusions among those: In actual practice, the correlation of history and geography is more prevalent at the present time than the fusion of the two fields. The three leading types of organization are the topical, the unit, and the biographical.

PUPIL ADJUSTMENT, GUIDANCE, AND WELFARE

SHIPP, FREDERIC T. "Social Activities of High-School Boys," *School Review*, XXXIX (December, 1931), 767-774.

From the social activities of high-school boys, the author concludes that there is a large majority who are socially immature and unsophisticated, and more attention needs to be given to this large group who need additional encouragement and confidence in their social life.

MEASUREMENTS, STATISTICS, AND METHODS OF EDUCATIONAL RESEARCH

BAKER, ROSS A. "The Relation of the Scientific 'Hunch' to Research," (Reprinted from *Journal of Chemical Education*, October, 1931), 33 pp.

The author presents an analysis of several hundred research workers relative to the conditions favorable to and unfavorable to research work.

DOCTORS' THESES UNDER WAY IN EDUCATION, 1931-1932

CARTER V. GOOD
University of Cincinnati

INTEREST on the part of professors, graduate students, and educational investigators in the list of Doctors' studies[1] in progress last year was so keen that the editors of the *Journal of Educational Research* have decided to make this service an annual feature. Comment is hardly necessary in pointing out the value of such a compilation with respect to avoidance of duplication, coördination of effort, and suggestion for further research. If two students are working on similar problems, correspondence or conference should aid materially in further delimitation of the field in such a way as to make possible two supplementary or complementary contributions rather than two reports which duplicate each other in many respects. For example, in the present list are two studies of the "History of Teacher Training in the United States" by students separated by a continent. They should profit by comparing notes on the scope of the field to be covered. In view of the trend toward coördinated research, as illustrated by the national surveys of secondary education, teacher training, school finance, modern foreign languages, social studies, and English usage, it seems only reasonable to eliminate duplication of effort and to break down some of the provincial isolation in working out Doctors' dissertations.

Investigators interested in the titles of completed graduate theses in education may locate such in the annual bibliographies of educational research published during recent years by the United States Office of Education; for the period previous to 1927 this information is found in bulletins published by the Bureau of Educational Research of the University of Illinois.

Obviously the service rendered by this annual compilation of Doctors' studies in progress would be impossible except for the coöperation of the various graduate schools and departments of education in this country.[2] Only two institutions have raised a question with respect to the value of publishing such information. The reasons given for failure to forward their titles are that: (1) some theses reported as under way may never be finished; (2) too many weak publications in education are appearing in print; (3) sometimes students do not answer satisfactorily inquiries concerning their problems under way; (4) there is little danger of duplication in educational investigation, making unnecessary such a list; and (5) publication of a given title may prevent some excellent student from undertaking a problem on which a weak individual is engaged and who never finishes it. To answer these objections briefly, (1) of course listing of a problem under way does not guarantee successful completion of the project; (2)

[1] Carter V. Good. "Doctors' Theses Under Way in Education, 1930-1931," *Journal of Educational Research*, XXIII (January, 1931), 85-112.

[2] The schools which forwarded titles for the present list are: Boston, California, Catholic University, Colorado State Teachers College, Columbia, Cornell, Harvard, Illinois, Indiana, Iowa, Johns Hopkins, Kansas, Kentucky, Michigan, Missouri, New York, Northwestern, Ohio, Oregon, Peabody, Pennsylvania, Pennsylvania State College, Pittsburgh, South Carolina, Southern California, Stanford, Temple, Virginia, Texas, Washington, West Virginia, Wisconsin, and Yale.

the present compilation has no connection with present or future publication of inferior articles or studies; (3) discourtesy or negligence on the part of recipients of inquiries concerning graduate theses is to be deplored; (4) there is much random overlapping of investigational effort and lack of coöperation, coördination, and planned repetition or verification of studies; and (5) the really strong student need not be frightened away from an area of vital interest in which another happens to be working, but should profit by knowledge of the scope involved and the procedure employed in the similar investigation.

In each instance the name of the candidate, title of the thesis, and graduate institution are given, in the order named. In most cases the name of the major adviser is given following the name of the university involved.

For the convenience of the reader a topical index has been prepared. An effort has been made to classify each thesis title under one or more appropriate major divisions of education. The numeral in each instance refers to the number of the thesis in the bibliography which is arranged alphabetically by surnames of candidates for the Doctor's degree. No distinction is made between Ph.D. and Ed.D. problems.

Certain problems listed last year are reported as still under way. Due to limitations of space, these titles are not reprinted in the present compilation, but are catalogued by number in the topical index. The numerals in brackets in the index refer to the list in the January, 1931, number of the *Journal of Educational Research*. However, if a candidate in the meantime has changed his problem or field of work materially, the new title is listed.

The alphabetical arrangement employed avoids the criticism of calling undue attention to the efforts of a given institution or professor in the graduate field. It is possible that certain institutions grant too many degrees; others may maintain such rigid standards of selection and an atmosphere of aloofness with the result that they "freeze out" promising students. Some advisers may carry too heavy a load, while others are underworked. The tendency toward a professionalized degree with a different type of thesis may or may not be deplored; this problem has been discussed in the 1931 yearbook of the National Society of College Teachers of Education. Thesis standards vary greatly throughout the various institutions. Too many weak schools may be granting Doctors' degrees. However, these are problems which cannot be treated satisfactorily on the single basis of a list of studies under way.

It is the opinion in some quarters that too many graduate degrees are granted each year. However, if teacher training in America is to approach the standards of German and French secondary schools, there is no cause for immediate alarm concerning the number of Doctors' degrees granted annually, assuming that appropriate standards of work are maintained. This statement suggests that a study of supply and demand in the graduate field, similar to investigations in the elementary and secondary teaching fields, is needed. Available data indicate that the number of Doctors' degrees awarded in education since 1917 is as follows: 1918, 53; 1919, 50; 1920, 61; 1921, 43; 1922, 68; 1923, 94; 1924, 110; 1925, 137; 1926, 181; 1927, 189; 1928, 194; 1929, 179 (probably not complete); July, 1929, to September, 1930, 323 (more than one year represented); 1931, 354 (approximate). The number of such

studies under way in 1930-1931 was more than 600. The new theses undertaken since the last compilation was printed total 468. When the new titles and the 246 incompleted projects of last year are combined, the number of Doctors' theses now under way reaches the total of 714.

In scanning the titles one receives the impression that in some instances a field rather than a specific problem is covered. This situation probably is due to the fact that the student had not delimited his problem definitely at the time the titles were compiled by the graduate institution. Another impression is that the field of education in certain institutions has extended itself to include Doctors' problems in a number of related fields: psychology, sociology, medicine, religion, economics, history, philosophy, etc., for example, "Studies in Learning by Horses," "Social Changes in Local Neighborhoods," "The Relation of Streptococci Infection to the Fragility of the Red Blood Cell," "The Modern 'Holiness' Movement," "Slavery and Justice," "Accounting for No-Par Stock Issued by Industrial Corporations Organized under the Laws of Delaware, Maryland, and New York," "The Use of a Bantu Culture in Religious Education," etc. Opinions differ as to the desirability of this increasing tendency toward expansion in education.

An examination of the topical index indicates that certain fields are investigated quite frequently, while others are seldom explored. As is to be expected, school administration and supervision, secondary education, elementary education, and psychology and measurement provide numerous problems for study. The field of educational theory, philosophy, and sociology makes a respectable showing. There is no evidence that the historical method is in the discard in education; it is true that many studies of foreign and comparative education swell the total under this heading. One is impressed by the large number of studies touching the college level, which has become increasingly of late years a center of investigational activitiy. However, this is a natural development in view of the fact that 75 percent of Doctors of Philosophy go into college teaching.

Interest continues in the special fields of English, religious and character education, physical and health education, and social studies. Character education especially seems to be a problem of current concern. A body of factual knowledge rapidly is being developed in health education. There are still no Doctors' theses under way in art education, and relatively few new studies in business education, foreign languages, home economics, industrial arts, mathematics, music, and science. Possibly workers in the foreign-language field feel that the Modern Foreign Language Study has settled their problems for the present; a more likely explanation is that relatively few teachers of a foreign language take a degree in education. The latter statement probably applies in the case of a number of other special school subjects.

The type of investigational effort here reported gives promise of looming increasingly large in establishing a factual basis for the field of education.

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NEW 1931-32 LIST

1. Acheson, Eunice. "The Effective Dean of Women." Columbia. Strang.
2. Adams, Henry L. "Study of Personnel in Certain Small Colleges." Yale. Hill.
3. Adams, Walter H. "Placement of Teachers as Carried on by Teacher-Training Institutions and Liberal Arts Colleges. Columbia. Kitson.
4. Aldrich, B. McCall. "Factors Determinative of School Organization: With Special Reference to Secondary-School Divisions." California.
5. Allen, Hollis P. "Practical Problems of City School Administration." Stanford. Cubberley.
6. Allen, Howard B. "A Study of Activities of Teachers of Agriculture in Dealing with Parent-Pupil Relations on the Home Farm." Cornell. Eaton.
7. Altenburg, West J. "The Relation of Muscle Hardness to Other Measured Elements of Growth and Nutrition." Columbia. Williams.
8. Ambrose, Luther. "A Study of the Public Academy of Kentucky." Kentucky.
9. Anderson, James Thomas. "Progressive Practices in Rural Education." Southern California. Ford.
10. Anderson, O. A. "Principles and

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11. Armacost, George H. "The High-School Principal's Annual Report." Columbia. Briggs.
12. Arnold, Frank J. "Is Vocational Coöperative Work in the New York City High Schools a Success or a Failure?" New York. Lomax.
13. Atkinson, A. M. "Selection and Validation of Materials for a College Course in Educational Measurements." Pittsburgh. Buckner.
14. Augustine, Grace M. "The Management of College Residence Halls for Women." Columbia. Andrews.
15. Axtelle, George E. "Some Implications of Progressive Educational Theory for the Organization of Curricular Materials." California.
16. Bader, Louis. "Curriculum Building for Sales Training in the Electrical Industry." New York. Payne.
17. Baird, W. J. "A Study of the Private Academy of Kentucky." Kentucky.
18. Baker, Alice M. "Achievement of Elementary-School Children in Relation to Behavior Problems." Columbia. Symonds.
19. Barden, Earle K. "Progress of Elementary-School Children." Texas. Ayer.
20. Barden, John G. "The Training of Native Teachers in Belgian Congo." Columbia. Carney.
21. Bardin, Shlomo. "Hechalutz, A Zionist Pioneer Movement: Its Cultural, Social, and Educational Aspects." Columbia. Kandel.
22. Barker, Leo V. "The Training for Social Religious Leadership Provided in the College Experience of Lay Leaders in a Selected Group of Churches." Columbia. Elliott.
23. Bartlett, J. W. "A Study of the Organization of Subject Matter and the Methods Pursued Among Graduate Students in the Field of Dairy Husbandry." New York. Creager.
24. Bayliss, William B. "A Study of a Foundation Established for Character Development in Boys." Columbia. Elliott.
25. Beall, Ross H. "A Study of an Individual-Instruction Unit in Long Division." Iowa. Knight.
26. Beaty, Ira O. "Rhythm, Melody, and Harmony as Preferential Factors in Pupils' Selection of Music (Experimentally Determined with 1500 Junior High School Pupils)." Hopkins. Bamberger.
27. Beck, Elton Wayne. "Equations Predicting Demonstrable Gains in Arithmetic in Terms of N. Factors." Iowa. Knight.
28. Beck, Ruth E. "Study of the Population of a Private Junior College." Kansas. Smith.
29. Bedell, Ralph C. "Learning on Different Levels in Definite Subject-Matter Situations." Missouri. Irion.
30. Bell, Carl. "A Study of Visual Education." Washington.
31. Bell, Lotta. "A Critical Analysis of Teacher Training Administered in the Seventh Day Adventist Church." Northwestern. Melby.
32. Bell, Robert E. "Provision for Education of Gifted Children in Elementary Schools of New York State." New York. Speer.
33. Bennett, John Newton. "The Selective Value of Granting Scholarships in Discovering and Winning Students Who Should Go to College." New York. Reed.
34. Berkhof, William. "The Development of Moral and Religious Training in the Public Schools of

Michigan." Michigan. Jackson.

35. Blackburn, Richard Leroy. "History of Education in the State of Arizona." Southern California. Scholtz.
36. Blodgett, Warren M. "The Youth Conference: An Agency for Training Young People for Leadership in the Church." Columbia. Elliott.
37. Bobst, Isaac James. "Moral Delinquency and Its Relation to Religious Education." Temple. Snyder.
38. Bollig, Richard J. "Catholic Education in Kansas." Catholic University of America. McCormick.
39. Bolzau, Emma. "The Educational Contribution of Almira Lincoln Phelps." Pennsylvania.
40. Bowler, Sister M. Mariella. "A History of the Catholic Women's College in the United States." Catholic University of America. Rooney.
41. Bradley, Amos Day. "Geometric Bases of Design." Columbia. Upton.
42. Brophy, B. J. "The Evolution of the Elementary Principalship." Michigan. Moehlman.
43. Brouillette, J. W. "The Development of Teacher Training in Louisiana." Peabody. Crabb.

43a. Brown, Forrest. "A Study of Configurational Learning by a Gorilla." Cincinnati. Pechstein.

44. Brown, F. J. "A National Survey of Educational Opportunities for Teachers in Service Afforded by Colleges and Universities in the United States." New York. Payne.
45. Browne, Robert B. "The Harvard Philosophers at the Opening of the Twentieth Century, with Special Reference to Educational Theory." Illinois. Cameron.
46. Browning, Ward. "Debating in the Secondary Schools of the United States." Columbia. Fretwell.
47. Bruce, Robert Hall. "The Influence of Variable Degrees of Motivation on Animal Learning." Ohio State. Renshaw.
48. Burge, L. B. "Analysis of Errors and Questionable Habits of Work Involved in the Mechanics of Multiplication." Michigan. Woody.
49. Burger, I. Victor. "An Experimental Study of the Development and Measurement of the Health of Elementary-School Children from the Third to the Eighth Grades Inclusive, Based on the Coöperation of the School and Home." New York. Payne.
50. Burts, Mary F. "A Study of Play as a Factor in Character Education." New York. Lloyd.
51. Byram, Harold Moore. "Some Problems in the Professional Education of College Teachers in Graduate Schools of Colleges and Universities." Columbia. O'Rear.
52. Byrns, Ruth Katherine. "The Prediction of College Success at the University of Wisconsin." Wisconsin. Henmon.
53. Campbell, John E. "Catholic Education in a Democracy." Catholic University of America. Jordan.
54. Campbell, Nellie M. "Specifics Applied to Behavior Problems in the Elementary School." Columbia. Gates.
55. Campbell, W. G. "A Study of Honesty." Stanford. Sears.
56. Cannon, Annie. "The Evolution of the Control and Support of Higher Institutions by the Commonwealth of Pennsylvania." Pittsburgh. Rohrbach.
57. Carroll, Elinor. "What is Good Reading, as Ascertained by the Practices of Good Readers and the

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58. Chambers, Jay Lea. ''Financial Accounting Records Required by the Several States for Their Public School System.'' Ohio State. Reeder.
59. Chang, Fletcher Y. ''The Organization and Administration of Health and Physical Education in the States.'' Columbia. Williams.
60. Cheek, William Virgil. ''What is the Demand for and the Supply of Teachers of Commercial Subjects in the Public High Schools of Missouri for the School Year 1931-32.'' New York. Lomax.
61. Childs, Gladwyn M. ''The Use of a Bantu Culture in Religious Education.'' Columbia. Elliott.
62. Childs, Will Paul. ''Investigation of the Building and Equipment Provisions for Secondary-School Shop Courses. Southern California. Ford.
63. Ching, J. F. ''Types of Windows as Factors in the Determination of Classroom Ventilation.'' California.
64. Christensen, Alfred. ''The Organization and Administrative Control of the Public Junior College.'' Northwestern. Melby.
65. Clauss, Howard D. ''Institutional Analysis of a Church College.'' Temple. Snyder.
66. Clish, Herbert L. ''Inducting the Beginning Elementary Teacher into Service.'' Columbia. T. Alexander.
67. Cole, Mary I. ''Coöperation between the Faculties of the Elementary Demonstration School and the other Departments of the Teachers College.'' Columbia. T. Alexander.
68. Conmy, Peter. ''History of Public School Finance in California, 1850-1930.'' California.
69. Concistre, Marie. ''Adult Education of the Foreign Born in a Local Area in New York City.'' New York. Thrasher.
70. Conklin, Agnes M. ''A Study of Behavior by Means of the Control Group.'' Columbia. Hollingworth.
71. Conlin, David A. ''A Study of the Individual Variability of Pupils.'' Yale. May.
72. Connelley, R. E. ''The Effect on Comprehension of Distance in Reading.'' Pittsburgh. Yoakam.
73. Connolly, Sabina H. ''Vocabulary Needed in Reading Literature Required for College Entrance.'' Yale. Hill.
74. Cooke, Robert L. ''Suggestions for a California State Program of Industrial Education for Girls.'' California.
75. Cooper, J. A. ''The Relative Academic Achievement of Athletes versus Non-Athletes as Measured by Comparative Objective Examinations.'' Pennsylvania State College.
76. Coops, Helen Leslie. ''Standards for Girls' Athletics in Ohio High Schools.'' Columbia. Williams.
77. Cressey, Paul Goalby. ''The Sociology of Motion Pictures.'' New York. Thrasher.
78. Cross, Jerome O. ''The Protection of Public School Property in California through Insurance, Safety Education, and Other Means of Reducing and Eliminating Risk.'' California.
79. Cunningham, Isabelle H. ''The Influence of a Bonus or a Salary Increment on the In-Service Training of Teachers.'' New York. Dearborn.
80. Cutten, George L. ''A Study of

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81. Cyr, Frank W. "The Determination of More Adequate Administrative Organization for Public Schools in Rural Areas." Columbia. Carney.
82. Damon, Kenneth F. "A Study of a Means of Measuring Reactions of Individuals to Music." Columbia. Dykema.
83. Daniel, Robert P. "A Psychological Study of Delinquent and Non-Delinquent Negro Boys." Columbia. Pintner.
84. DasGupta, Debendra C. "The Pl of Vocational Education in Mo Educational Philosophy from the Sixteenth to the Twentieth Century." California.
85. Davis, Burton E. "Guidance for Youth." Southern California. Lefever.
86. Dean, Council. "Factors Associated with Salaries of Teachers in Arkansas." New York. Meredith.
87. Decker, Charles E. "The Nature and Improvement of Correspondence Work for Teachers." New York. Dearborn.
88. DeYoung, Chris A. "Budgetary Practices in Public School Administration." Northwestern. Melby.
89. Diener, Harry C. "A Study of the Reasons Underlying the Decline of Academies in New York State." Cornell. Jordan.
90. Dillman, Willis. "The Correlation of Religious Agencies in a Metropolitan Area." Temple. Snyder.
91. Distler, Theodore A. "A Study (in Detail) of the Class of 1924 in University College." New York. Reed.
92. Dodd, M. R. "Evaluating Supervisory Procedures with Student Teachers." West Virginia.
93. Doxsee, E. D. "A Procedure of Determining Junior-College Needs for a City's School District." California.
94. Doyle, John J. "Nationalistic Trends in Modern Educational Legislation." Catholic University of America. Johnson.
95. Driggs, H. Wayne. "What Are the Written Composition Skills of Junior High School Pupils?" New York. Cox.
96. Dunn, Maud E. Wilson. "Vocabulary Difficulty of Secondary Pupils of Varying Ability Levels." Southern California. Lefever.
97. Durost, Walter N. "Collecting as Related to Social Adjustment." Columbia. Hollingworth.
98. Eakin, Ruth Morgan. "A Study of Private Secondary Education in the United States." Southern California. Weersing.
99. Eastwood, Floyd R. "Age-Grade Cross Section of Likes and Dislikes of Children." New York. Lloyd.
100. Eaton, Merrill T. "Construction of a Curriculum for Secondary-School Students in Home Planning and Building." Indiana. Lewis.
101. Ebaugh, Mary O. "Beginnings of Higher Education in Maryland." Hopkins. Bamberger.
102. Ehrenfeld, Abraham. "Experimental Investigation of the Causes of Failures of Pupils and Their Remedy." New York. Radosavljevich.
103. Ehrhart, Earle V. "Vocational Interests of 5000 Boys in Grades 5 to 12." Yale. Hartshorne.
104. Ehrlich, Maxwell. "A Study of the School Population of the Staten Island Continuation School." New York. Zorbaugh.
105. Elliott, E. B. "Some Phases of

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106. Emerson, Lynn A. "History and Present Status of Employment Service in the Y.M.C.A. of New York City." New York. Reed.

107. Endicott, Frank S. "A Study of the Activities Carried on by Home Rooms and Adviser Groups During the Regular Guidance Period." Northwestern. Hamrin.

108. Fagerstrom, William H. "Secondary Mathematical Knowledge Prerequisite to College Mathematics." Columbia. Upton.

109. Fairchild, R. W. "Administrative Procedure in the Improvement of Teacher Training." Northwestern. Melby.

110. Featherstone, William B. "Vocational Education of the Mentally Handicapped." Columbia. Mort.

111. Feig. C. A. "The Effectiveness of Correspondence Instruction." Pennsylvania State College.

112. Fernald, Roy. "A Survey of Secondary Education in Maine." Boston. Davis.

113. Findlay, Warren G. "Specialization of Verbal Facility at College-Entrance Level." Columbia. Ruger.

114. Fitzpatrick, Katherine L. "Teaching Techniques in Junior High Schools." Yale. Hill.

115. Fitz-Simons, Marion J. "Parent-Child Relationships as Shown in Clinical Case Studies of Children." Columbia. Meek.

116. Foster, Charles R., Jr. "Student Participation as a Means of Teacher Training in the Teachers Colleges and Normal Schools of New Jersey." Harvard. Brewer.

117. Foster, Frank C. "The Bearing of Part-Time Employment on Training for the Ministry." Columbia. Elliott.

118. Foster, Gertrude. "Documentary History of Education in South Carolina, as Revealed in the Manuscripts of the Society for the Propagation of the Gospel and Other Learned Societies." South Carolina.

119. Franklin, Ezra T. "The Modern 'Holiness' Movement: A Study in Religious Experience." Columbia. Kilpatrick.

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121. Fraser, Mowat Gjems. "A Critical Study of Outstanding Recent Proposals for Improving Instruction in American Liberal Arts Colleges." Columbia. Raup.

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125. Frederick, Orie I. "A Check List of Desirable Practices in the Organization of High Schools." Michigan. Schorling.

126. French, L. C. "Effect of Training on Improvement of Ability to Read and Study Geography." Pittsburgh. Yoakam.

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132. Gandy, Roxanna S. "A Study of Third-Grade Children of Urban and Rural Sections to Help Determine to Some Extent the Differences in the Most General Outside-School Experiences of the Two Groups." Pennsylvania.
133. Ganley, Mary K. "An Evaluation of Grades Made by Graduates and Undergraduates in the School of Education of New York University." New York. Reed.
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135. Gardner, L. Pearl. "Studies in Learning by Horses." Cornell. Kruse.
136. Garwood, Harry C. "A Study of Development and Trends in Religious Education in Southern Baptist Class-A Colleges from 1900-1925." Yale. Weigle.
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161. Haught, D. L. "The History of Teacher Training in West Virginia." Pittsburgh. Rohrbach.

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263. Marple. Nathan Boileau, Jr. "The Educational Implications of the Economic Aspects of John Dewey's Philosophy." Ohio State. Bode.

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268. Marston, R. B. "A Comparison of the Relative Effectiveness of a Conventional and of a Dalton Or-

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337. Pugh, David. "Construction of a Battery Achievement Test Adapted to Mechanical Scoring and Containing Certain New Features Regarding Norms and Diagnosis. Pennsylvania State College.

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339. Ramsay, Calvin H. "Cost of Living and Economic Status of Teachers in Missouri." Missouri. Capps.

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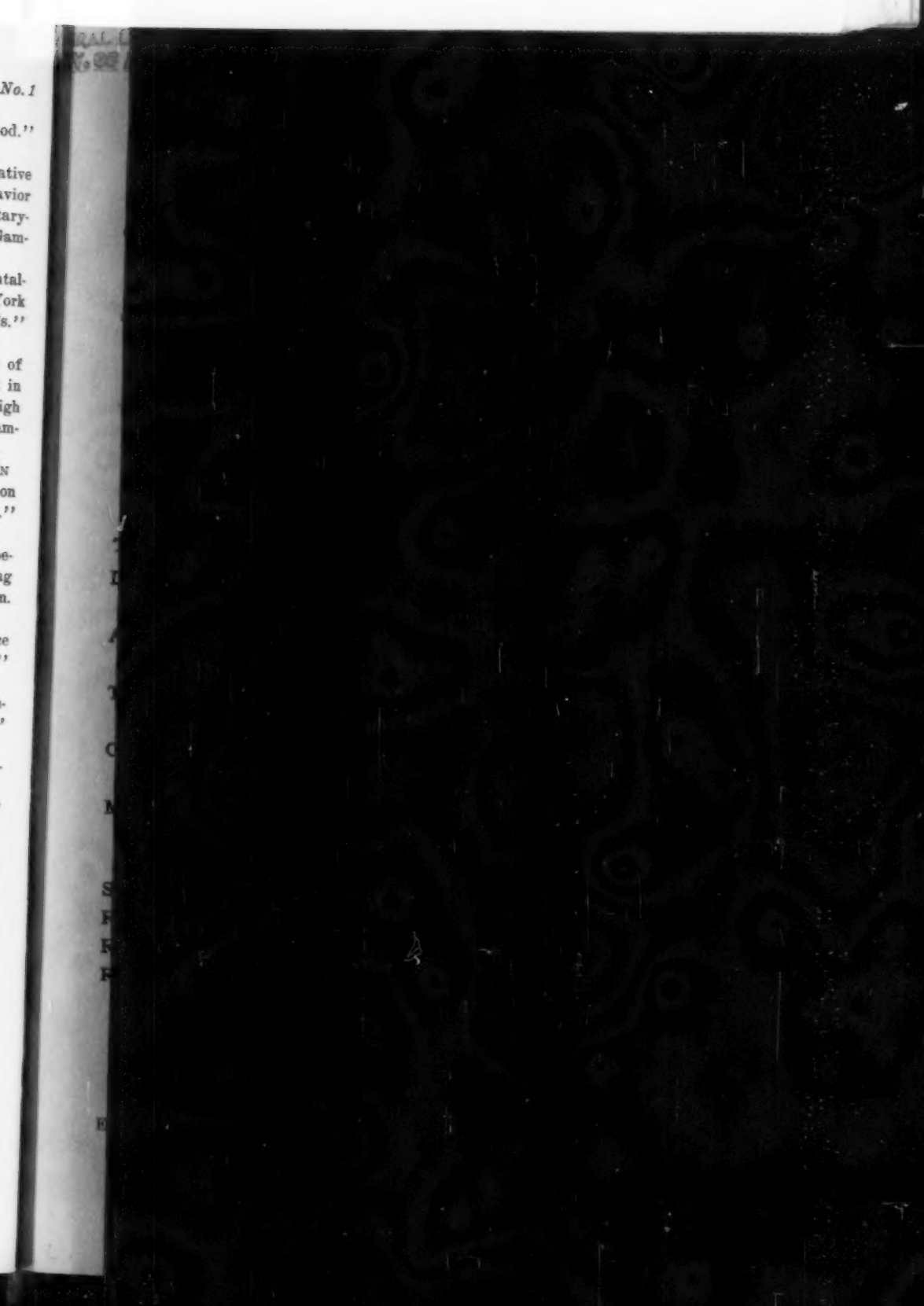
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